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INDUSTRIAL • COMMERCIAL • INSTITUTIONAL • PUBLIC BUILDINGS

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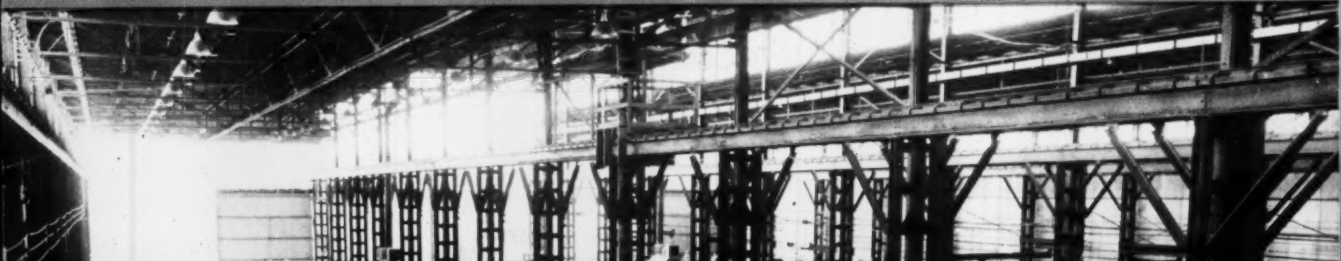

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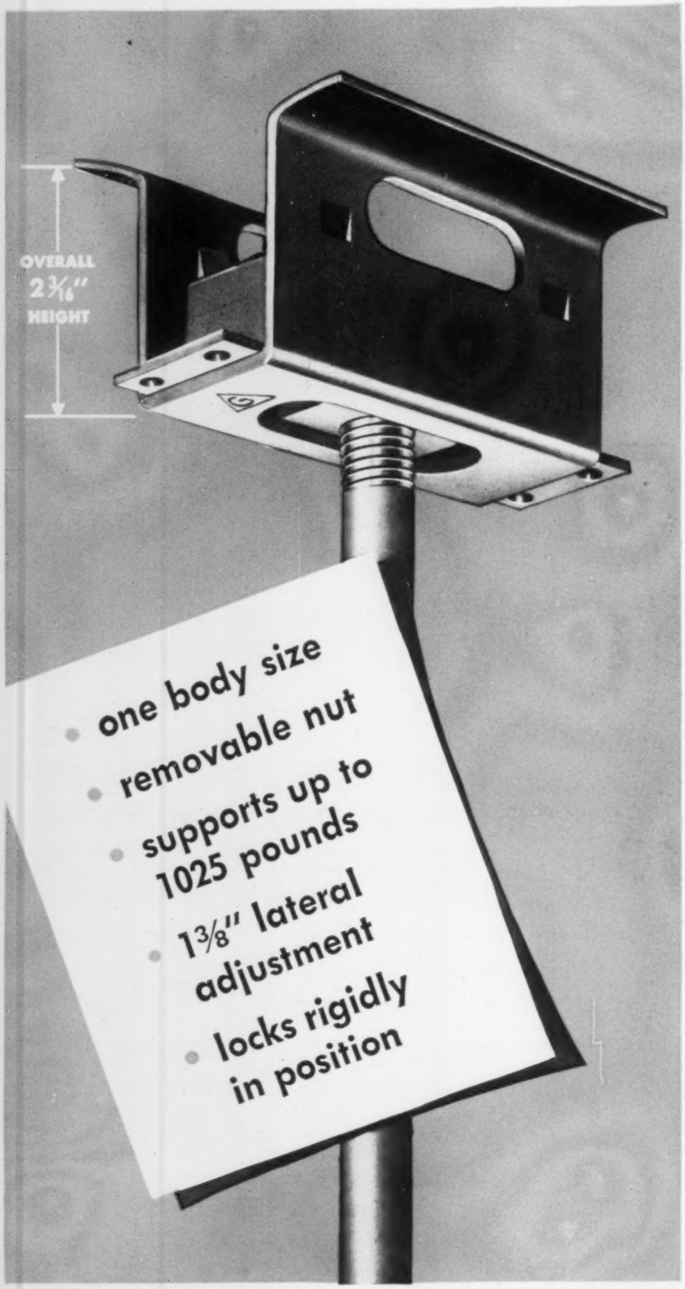
The new GRINNELL Wrought Steel CONCRETE INSERT


OVERALL
2 3/16"
HEIGHT
one body size
removable nut
supports up to 1025 pounds
1 3/8" lateral adjustment
locks rigidly in position

The newly designed Grinnell Wrought Steel Concrete Insert (fig. 280) is the economical answer to many overhead pipe suspension problems. It is made of heavy gauge steel and made to facilitate the use of various rod sizes. With but a single body size, manufacturing costs are reduced, ordering is easier, and installation simplified. This can mean a saving of time, trouble, and money for you.

The Grinnell Wrought Steel Concrete Insert is recessed to accommodate a special removable nut which is furnished with a 3/8, 1/2, 5/8 or 3/4 inch tapping. Once the rod or bolt is screwed tight, the nut is rigidly locked in place. Before tightening, the rod position may be adjusted laterally as much as 1 3/8 inches.

Thin-slab construction presents no problem. Overall height of insert, minus rod, is only 2 3/16 inches. The top edges are bent outward for solid anchoring. Slots in the sides will pass reinforcing rods up to 1/2 inch in diameter. With a load rating of 1025 pounds per unit (610 pounds for 3/8 inch rods), Grinnell's Wrought Steel Concrete Insert is rugged and inexpensive.

GRINNELL

AMERICA'S No. 1 SUPPLIER OF PIPE HANGERS AND SUPPORTS

Available from your local distributor

Grinnell Company, Inc., Providence, Rhode Island

Manufacturer of: pipe fittings • welding fittings • forged steel flanges • steel nipples • engineered pipe hangers and supports Thermolier unit heaters • Grinnell-Saunders diaphragm valves • prefabricated piping • Grinnell automatic fire protection systems

United States Air Conditioning Corporation

and Sterling Heat Specialties Incorporated

of Westfield, Massachusetts, announce

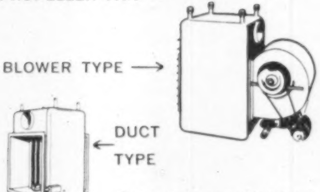
a new jointly-owned company . . . STERLAIRCO, INC.

for the manufacture and sale of

usAIRco GAS UNIT HEATERS

PROPELLER FAN

Now you can sell usAIRco gas heaters even more profitably! Specialized manufacturing facilities, in Westfield, with all modern equipment assures a product of highest quality at a profit-making price!



Sizes and capacities from 50,000 to 500,000 BTU/hour

Advanced Engineering Features!

The unique design of the usAIRco heater eliminates both hot spots and cold spots on the heat exchanger surface. Instead of the conventional combustion box each tube is designed as its own individual combustion chamber and is individually fired. By heating the tubes uniformly, relatively even temperatures are maintained and the hazard of burn-outs or rust-outs due to overheating or underheating are avoided.

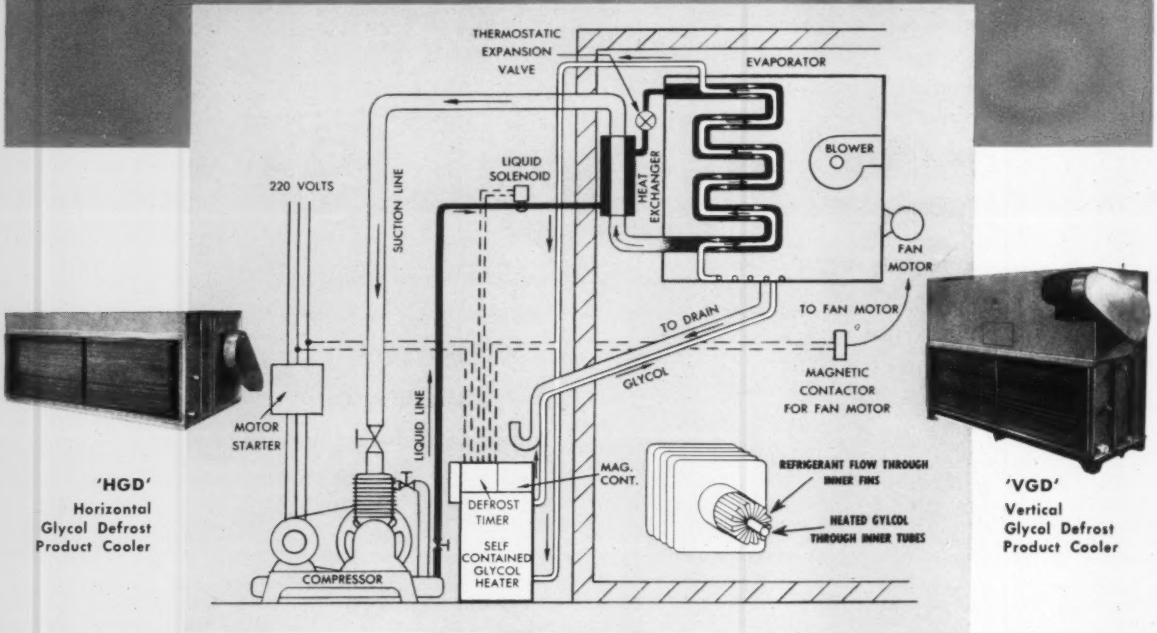
This, together with all-welded, rugged construction, guarantees sustained durability.

Address inquiries to B. C. Scott, vice-president

STERLAIRCO, INCORPORATED Westfield, Massachusetts

usAIRco
GAS UNIT HEATERS

POSITIVE TROUBLE-FREE DEFROSTING WITH NEW GD GLYCOL DEFROST PRODUCT COOLERS BY BUSH


THERMOSTATIC EXPANSION VALVE
EVAPORATOR
LIQUID SOLENOID
BLOWER
HEAT EXCHANGER
220 VOLTS
SUCTION LINE
FAN MOTOR
TO DRAIN
TO FAN MOTOR
GLYCOL
MAGNETIC CONTACTOR FOR FAN MOTOR
MOTOR STARTER
LIQUID LINE
MAG. CONT.
REFRIGERANT FLOW THROUGH INNER FINS
DEFROST TIMER
HEATED GYLCOL THROUGH INNER TUBES
SELF CONTAINED GLYCOL HEATER
COMPRESSOR

'HGD'
Horizontal Glycol Defrost Product Cooler

'VGD'
Vertical Glycol Defrost Product Cooler

BUSH 'GD' Glycol Defrost product coolers feature famed Inner-Fin coil construction. This design — exclusive with Bush — permits units to defrost *from the inside.*

Entirely separate defrosting circuit consists of glycol pump, cast aluminum glycol heater, timer and magnetic contactor — supplied as an assembled kit.

Heated glycol is circulated *within the inner tube,* and Inner-Fin design permits rapid distribution of heat to point where frost forms. As a result, units defrost quickly . . . room temperature rise is held to a minimum.

Complete containment of glycol eliminates dilution of defrosting medium, abolishes need for replenishing or distilling, reduces danger of defrost failures from freeze-up.

Hot glycol circulation in drain pan also insures proper carry-off of water as unit coils are defrosted.

Available in compact floor-mounted or ceiling-hung models. Write for complete information.

BUSH

BUSH MANUFACTURING COMPANY · West Hartford 10. Connecticut

RIVERSIDE · CALIFORNIA

Heating Piping & Air Conditioning

Vol. 27 No. 7

(with which is merged the Aerologist)

DESIGN, INSTALLATION, OPERATION AND MAINTENANCE IN INDUSTRIAL, COMMERCIAL, INSTITUTIONAL AND PUBLIC BUILDINGS

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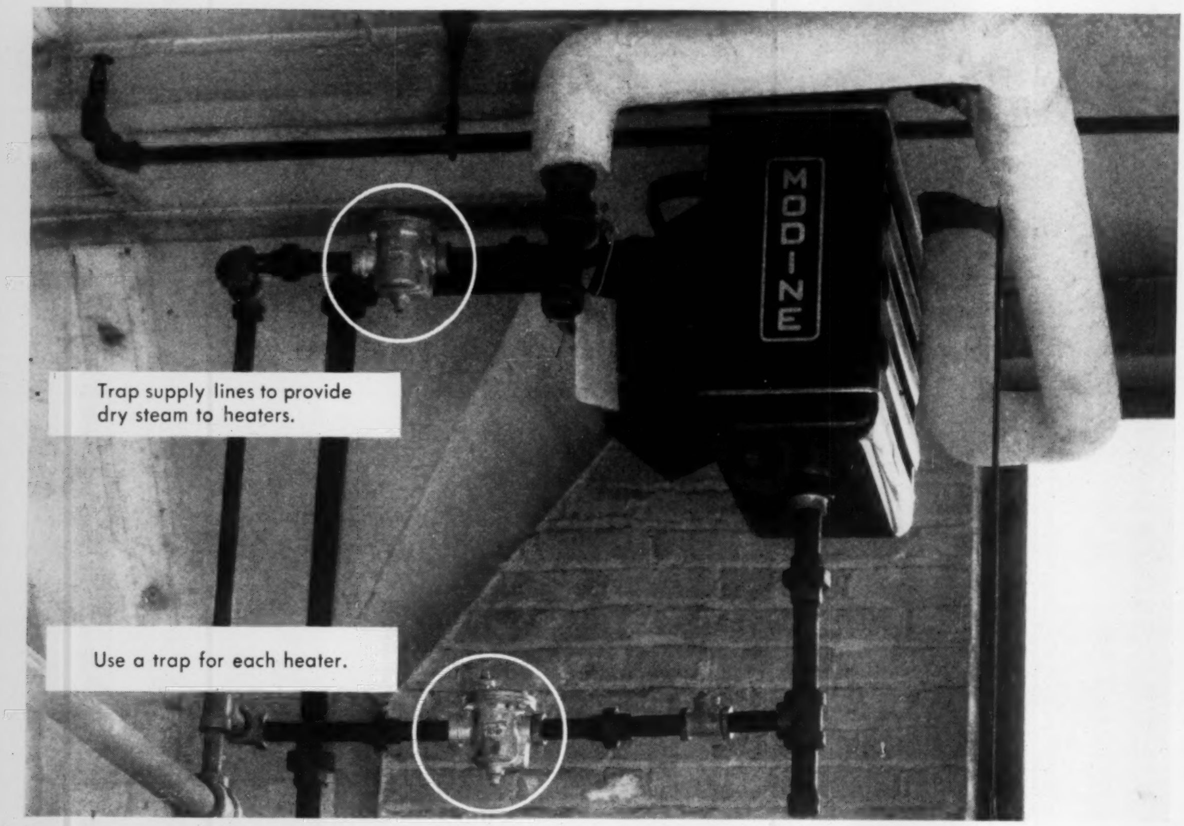
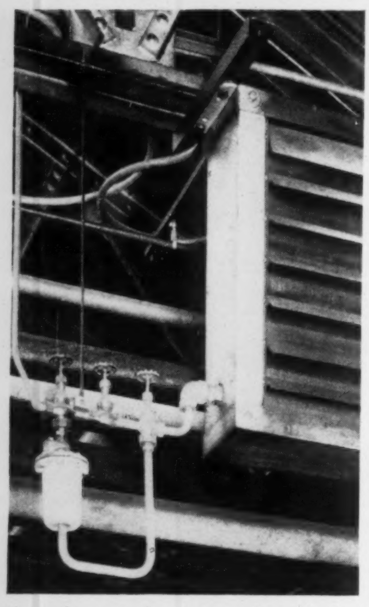

MODINE
Trap supply lines to provide dry steam to heaters.
Use a trap for each heater.



Use a bypass above trap where heater must be kept in operation at all times. Note neat hookup possible with Armstrong vertical connection trap.

Tips on Trapping Unit Heaters for Full Output and Low Maintenance

• If unit heaters are clean and the steam supply and return lines are adequate, their performance will depend entirely upon the steam trapping. Here are some trapping pointers to insure plenty of heat when it is needed:

1. Trap supply lines to take care of condensate formed by radiation loss.

2. Use one trap for each heater. Two or more heaters drained by a single trap will fail to deliver maximum btu output.

3. Size traps properly. Many a unit heater is handicapped by a trap lacking adequate condensate and *air* handling capacity. The few dollars extra for larger traps insure fast heatup, full output and freedom from coil corrosion.

4. Install traps correctly. Put trap below and close to heater. Install a bypass around the trap if the heater must be kept in operation at all times. A shut-off valve in the discharge line facilitates trap inspection. Use of check valves and strainers is dependent upon piping conditions and the traps used.

5. Protect against PRV failure where freezing could occur. Sometimes heaters supplied with reduced pressure steam are installed where freezing could occur if traps failed to open. In this case select traps that will open at maximum steam supply pressure and still have adequate capacity at reduced pressure.

FREE ON REQUEST—COMPLETE INFORMATION on the above points, diagrams, selection data, tables and additional recommendations are contained in Armstrong Bulletin No. 2312. Also includes BTU output ratings for all models of 30 makes of unit heaters. Call your local Armstrong Factory Representative or write:

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ARMSTRONG
APPLICATION ENGINEERED
STEAM TRAPS

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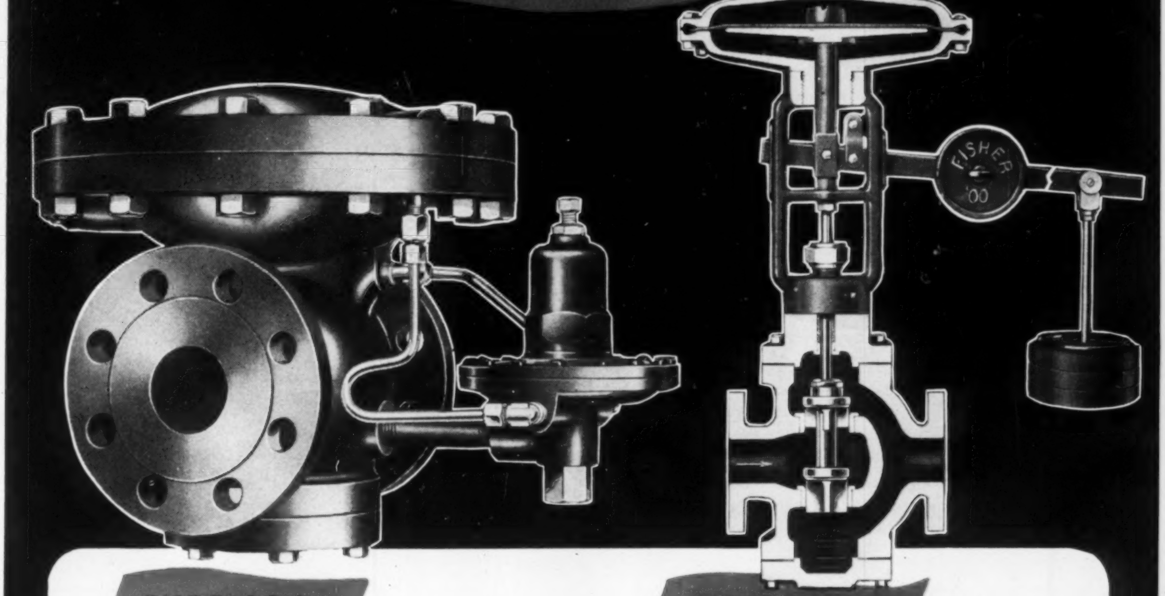

TYPE 92A

TYPE 10A

PILOT OPERATED PRESSURE REDUCING VALVE

Built for long dependable service for steam pressure control. The 92A features single seated hardened stainless steel construction, assuring tight closure and preventing excessive pressure build-up. Pilot control maintains desired reduced pressure with remarkable accuracy. Two pilot assemblies for high or low pressure are available and interchangeable.

Sizes ½" to 2" screwed; 1" to 6" flanged. Reduced pressure ranges 3 to 200 PSI. Inlet pressures to 250 PSI at 450°.

LEVER and WEIGHT CONTROLLED PRESSURE REDUCING VALVE

An extremely sensitive, simple yet rugged controller for reducing steam or gas pressures. Double ported globe bodies can be inverted to allow conversion to a relief valve. Swing-link yoke and balanced lever construction permits installation with diaphragm either above or below pipeline.

Sizes ½" to 2" screwed; 1" to 10" flanged. Reduced pressure ranges ½ to 100 PSI. Inlet pressures to 600 PSI at 800° or 1200 PSI at 100°. Bronze or stainless steel trim.

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REGULATORS AND IN RESEARCH FOR BETTER PRESSURE CONTROL

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ANNIVERSARY

How Honeywell Customized Temperature Control helps provide

The kind of "Indoor Weather" your clients need

Customized Temperature Control installation at Corning Glass Center is a good example.

At the Corning Glass Center in Corning, New York, you'll find a museum, offices, shops—and production areas where Steuben glassware is made.

Such a variety of functions under one roof calls for scientific temperature control—if the "indoor weather" is to be comfortable throughout the building.

Today the best way to provide proper "indoor weather"—whether a building houses one function or many—is through the use of *Honeywell Customized Temperature Control.*

The key word here is "customized". It means that whatever your clients' control requirements, a Honeywell Customized Temperature Control installation *designed to fit the needs of the building and its occupants is your answer.* This applies not only to heating and cooling, ventilating and humidity control—but to industrial control as well.

Only Honeywell can provide true "customized" control. Because only Honeywell manufacturers all three types of controls—pneumatic, electric and electronic.

The story, in brief form, of the Honeywell Customized Temperature Control installation in the Corning Glass Center is told by the floor plan and picture captions you see here.

They tell how specific occupancy, use and exposure problems were met.

The *techniques* used, applied to your particular problems, can help you give your clients the "indoor weather" they've always wanted.

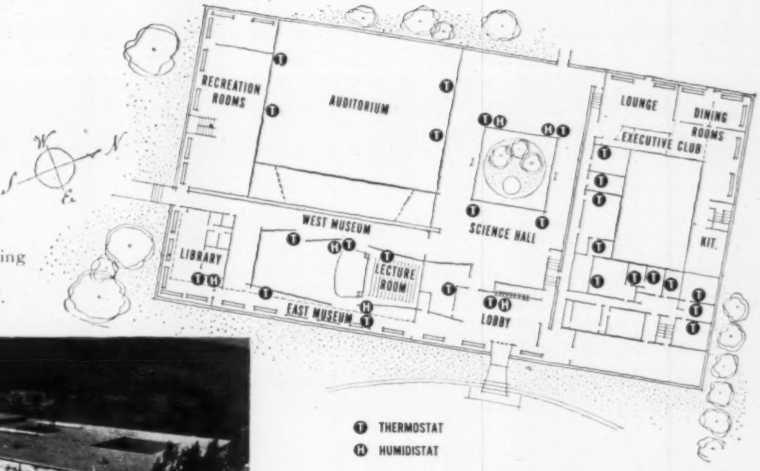
Interior garden of Corning Glass Center

GLASS FOR LIVING

Architects: Harrison & Abramovitz and Abbe, New York, N. Y.

Mechanical Consulting Engineers:
Jaros, Baum & Bolles, New York, N. Y.

Air Conditioning Consulting Engineers: Henry Peck Associates, Fairport, N. Y.



This panorama of the Corning Glass Center shows the temperature control problems involved. Huge glass window areas face four directions. Whether it is sunny or cloudy makes a big difference to the heating and cooling system. But Honeywell Customized Temperature Control, using electronic and pneumatic thermostat and humidistats, keeps the building comfortable all the time.

Interior heating and cooling factors are important, too. Take the auditorium above, for instance. With a large crowd you have one heating problem. With a small group, quite another. But the four Honeywell thermostats located here handle either situation easily.

The internal heating problem in the display room above is somewhat similar to that of the auditorium. But when it is crowded (requiring little heat) the auditorium might need considerable heat. Yet with enough thermostats, strategically placed, both areas are comfortable.

For comfortable, more productive temperature in new or existing buildings—of any size—specify Honeywell Customized Temperature Control

Whether it's a factory, motel, hospital—or any building of any size—new or existing, Honeywell Customized Temperature Control can help meet your clients' heating, ventilating, air conditioning and industrial control problems. You can give your clients more comfort and efficiency. And they'll save fuel, too.

For full facts on Honeywell Customized Temperature Control and the economical Periodic Maintenance Plan, call your local Honeywell office. Or write Honeywell, Dept. HA-7-111, Minneapolis 8, Minnesota.

James M. Brown, III, director of the Corning Glass Center, says:

"Today our Glass Center is one of the most comfortable buildings in the country. Important in helping make possible this comfort is our Honeywell Customized Temperature Control installation."

MINNEAPOLIS
Honeywell

Customized Temperature Control

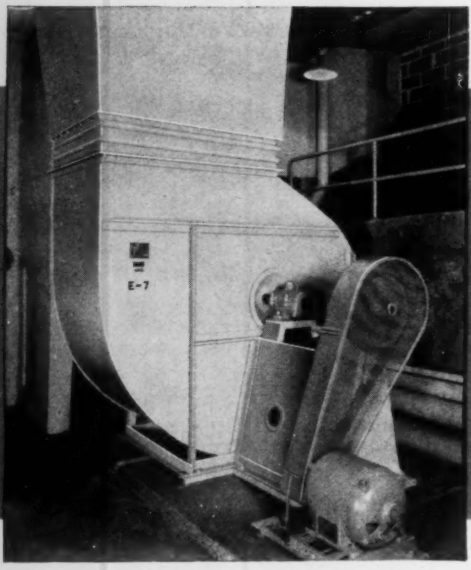
H
HONEYWELL

112 offices across the nation

Another Statler Hotel
for AIR COMFORT AT ITS

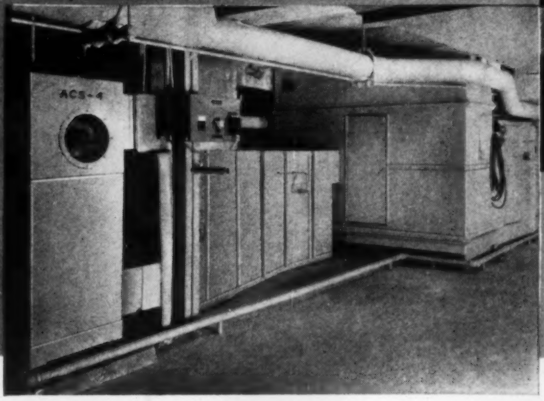
The handsome new Statler Hotel in Hartford, Conn. is another in the long list of large buildings enjoying air comfort by "Buffalo". This installation includes ventilation in all public rooms and service areas by "Buffalo" Fans, plus ideal climate for these areas, provided by "Buffalo" Air Conditioning Cabinets. The large quantities of chilled water and hot water needed for the air conditioning system and power plant are efficiently delivered by "Buffalo" Centrifugal Pumps.

Insure permanent satisfaction in every air and liquid handling job by specifying the "Q" Factor* units used in many of the country's finest installations for 78 years — "Buffalo" units.



"BUFFALO" VENTILATING FANS like this low-decibel, high-performance Type "BL" Fan do a highly satisfactory ventilation job and supply air for the air conditioning cabinets. These fans are non-overloading and very stable in performance. For ratings, write for Bulletins F-102 and 3720.

"BUFFALO" AIR CONDITIONING CABINETS provide made-to-order temperature, humidity and cleanliness in Hartford Statler air. One unit is shown above. For details on these efficient, sturdily built units, write for Bulletin 3703.



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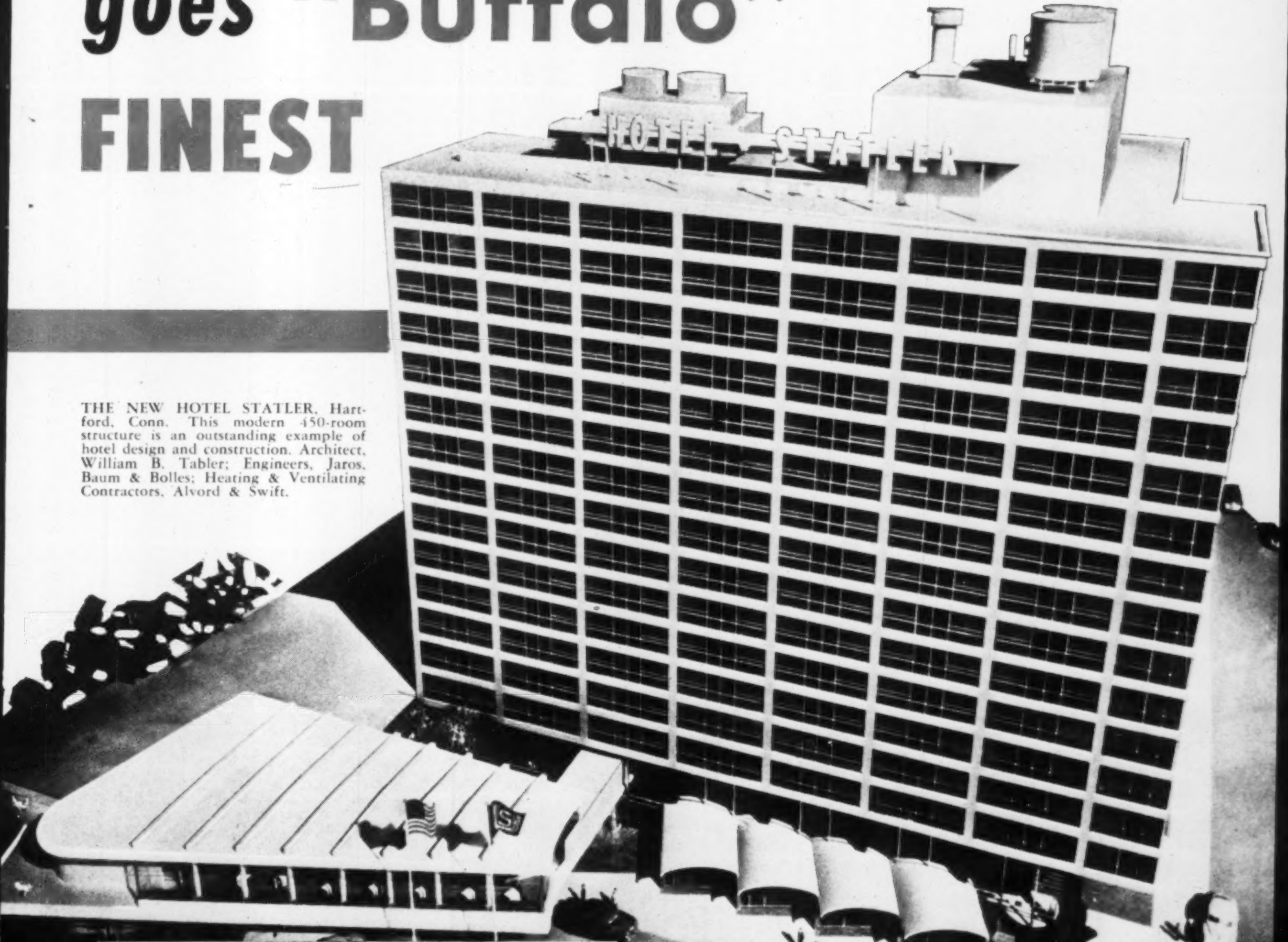
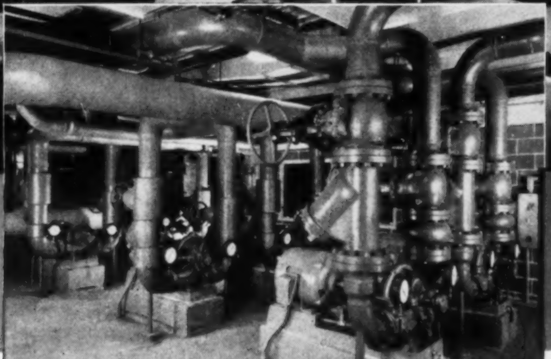
THE NEW HOTEL STATLER, Hartford, Conn. This modern 450-room structure is an outstanding example of hotel design and construction. Architect, William B. Tabler; Engineers, Jaros, Baum & Bolles; Heating & Ventilating Contractors, Alvord & Swift.





"BUFFALO" PUMPS supply the boilers and air conditioning units 24 hours a day. Do you have a complete binder of "Buffalo" Pumps Bulletins? If not, request one today on your letterhead.

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BUFFALO, N. Y.

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EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING

FOR *Fabulous* FONTAINEBLEAU

Miami Beach's new $15,000,000 Fontainebleau Hotel depends on Chase Copper Tube and Fittings for entire plumbing and air conditioning systems!

Luxury and practical utility are perfectly combined at the Fontainebleau! Everything is top quality—so Chase Copper Tube and Fittings were chosen for the plumbing and air conditioning systems!

Using Chase Copper Tube and Fittings pays off in top-performing, longer-lasting systems that add extra value to any home or building. Such systems, too, cost *little or no more* than ones of ordinary rustable materials! That's because Chase copper tube and fittings can be installed faster—substantially reducing installation costs! Use Chase copper tube and fittings on your next job!

Here's how the mechanical contractors sum up their reasons for using Chase materials:

"We have been using Chase Brass and Copper for many years. Chase has always maintained the highest quality in their industry. Their quality along with their excellent service to customers is a combination that makes Chase superior."

—MARKOWITZ BROS., INC., MIAMI, FLA.

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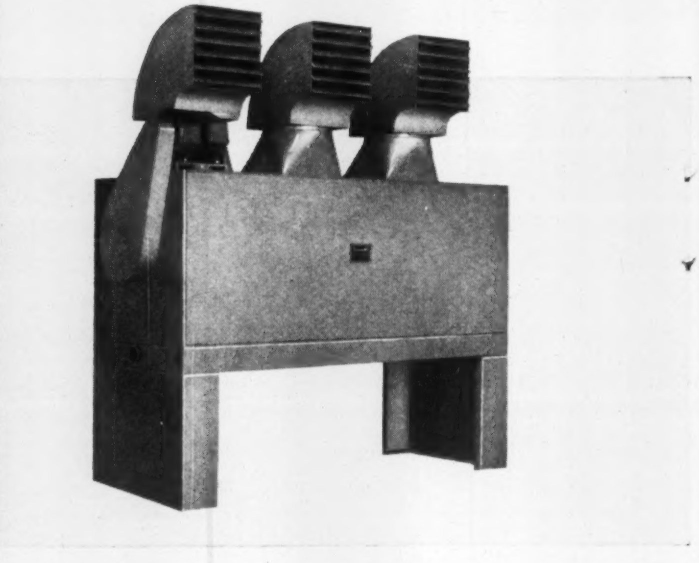
The new

in the Nesbitt line

- ★ Eight basic sizes, 24 models, 15,000 to 335,000 Btu/hr
- ★ Universal coil for maximum performance on steam or hot water
- ★ Coils made for high water capacities and temperature drops
- ★ Low water rates effect savings in piping and installation
- ★ Minimum air-flow resistance reduces noise and operating costs
- ★ Seamless copper tubes and bends; corrugated aluminum fins
- ★ Male pipe connections through casing rear save time and space
- ★ Balanced aluminum fans for quiet, large-volume air delivery
- ★ Heavy gauge, die-formed steel casings for modern interiors
- ★ Deep drawn air intake opening for maximum fan performance
- ★ Easily adjustable louvers, available with double deflectors
- ★ Green metallic hammered finish baked on bonderized steel

LITTLE GIANT UNIT HEATERS . . . Eight basic sizes, choices of heating element, 28,500 to 512,000 Btu/hr; three blow-through (down-blow) models, five draw-through (down- or horizontal-blow) models. Pub. 402.



GIANT UNIT HEATERS . . . Twelve basic sizes each with choice of ten heating elements, steam or hot water; one, two, or three fans; for large capacity heating and/or ventilating; four ways of mounting. Pub. 404.

whenever you have a heating or ventilating problem

propeller-fan heater

of industrial and commercial unit heaters . . .

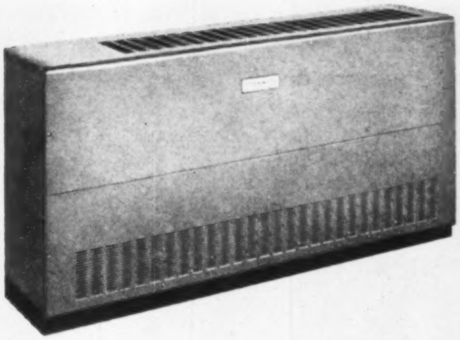
This wholly new Nesbitt propeller-fan unit heater offers an unusual combination of values in construction, performance, appearance and cost.

Its *universal* heating coil of continuous tube design *performs equally well with either steam or hot water*—an innovation that cuts inventory and warehousing costs in half.

Exact selection is simplified by the choice of 24 models (eight basic sizes) with capacities ranging from 15,000 to 335,000 Btu/hr. Pub. 401.

A careful study of the partial list of special features on the opposite page is recommended. It will explain why these new units are extremely flexible in their application, easy to install, surpassing in performance, quiet, long-lived, economical, and fit for the finest interiors.

The advanced styling and performance of all Nesbitt Unit Heaters is the result of over forty years of progressive engineering and technical improvement—to help keep you in the lead.



SERIES C UNIT HEATERS . . . Five sizes, 34" to 74½" long, each with choice of two steam or one hot-water heating element; two to five fans; recess, semi-recess, and non-recess fronts; 35,100 to 148,000 Btu/hr. Pub. 403.

GAS-FIRED UNIT HEATERS . . . Seven models, 25,000 to 200,000 Btu/hr input, 400 to 2900 cfm; A.G.A. and U.L. approved for all gases; most advanced styling and many features to simplify installation. Pub. 280.

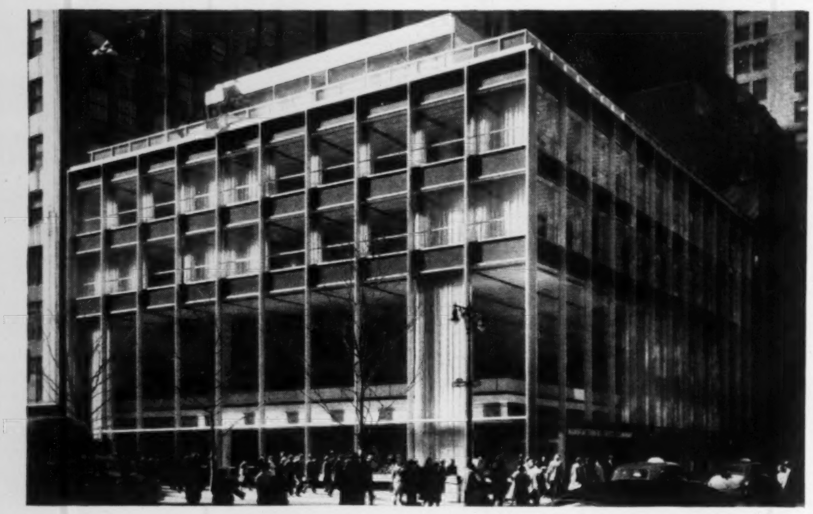
think first of this name

Nesbitt

INDUSTRIAL UNIT HEATERS

Manufactured by
John J. Nesbitt, Inc., Philadelphia 36, Pa.
Sold by Leading Wholesalers—Information on request.

WHY Worthington rates so



UNUSUAL DESIGN

Completely sheathed in glass, the new Manufacturers Trust Building in New York posed an unusual air conditioning problem. The job is taken in stride by a modern Worthington central station system consisting of two 150-ton packaged water chillers.

HEAVY TRAFFIC

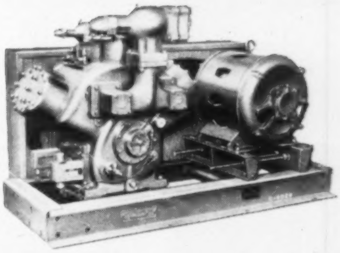
Keeping more than 12,000 people cool daily at New York City's new airlines terminal is a tough job. It's handled by a 315-ton Worthington centrifugal refrigeration system, together with Worthington air handling equipment and pumps.

HUMID HEAT

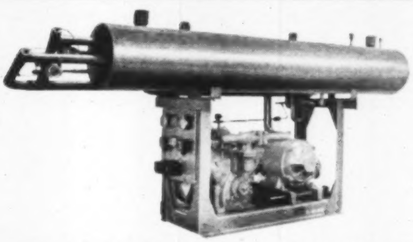
The Sterling, Miami Beach's newest oceanfront hotel, has *everything* but humid heat! An all-Worthington air conditioning system cools 142 rooms and 186,000 cubic feet of dining room and lobby space. Basic unit is a 60-ton Worthington "million-dollar" Freon compressor. Worthington packaged units are also spotted at key points.

many key air conditioning jobs

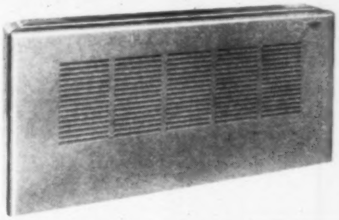
There are good reasons why unusual design, traffic or climate conditions can't trip up a Worthington dealer. He handles the most complete line of central station equipment in the industry. And, he's backed by Worthington's 70 years of specialized air conditioning experience. With assets like these, he's ready to take on *any* air conditioning job! For more details about the complete line, write Worthington Corporation, Air Conditioning and Refrigeration Division, Sect. A.5.57-HP, Harrison, New Jersey.



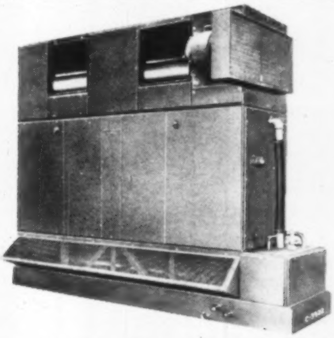
NEW FREON COMPRESSOR. Marked by sturdy construction and higher operating speeds, the new Freon compressor line ranges from 3-150 hp. Scientific balancing of rotating and reciprocating elements assures quiet, vibration-free operation.



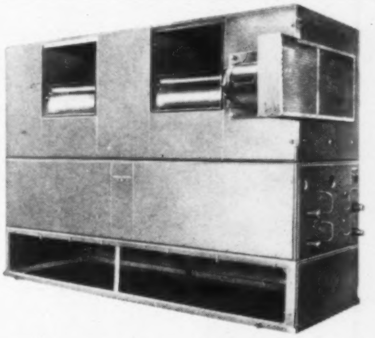
COMPACT LIQUID CHILLERS, in sizes up to 200 hp, provide dependable air conditioning where chilled water is used as the cooling medium. Factory assembled units show trim design; require minimum floor space. "Hearts" of these units are Worthington Freon Compressors.



INDUCTION CIRCULATOR. Room air conditioning unit operating on high-pressure air induction principle. Used for perimeter cooling and heating of multi-story buildings. Absence of moving parts means long life, quiet operation. 75 to 1000 CFM total air distribution.



EVAPORATIVE UNITS are designed for application where water is high in cost or temperature. Units reduce water consumption by 90% or more; do not require cooling towers. Can be adapted for indoor or outdoor use. Six sizes range from 10 to 150 tons.

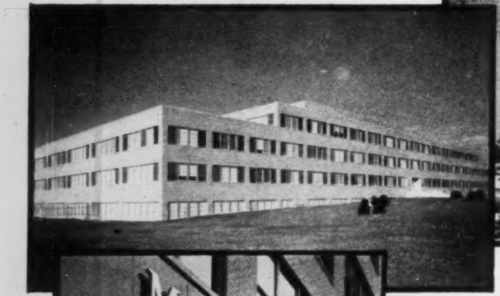


AIR HANDLING UNITS for remote air conditioning. Cooling coils available for direct expansion Freon-12, Freon-22, or chilled water. Floor and ceiling mounted units are functionally designed for easy installation and operation. 1,400 to 13,500 CFM.

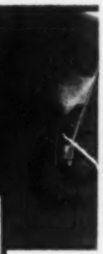
A.5.57

WORTHINGTON

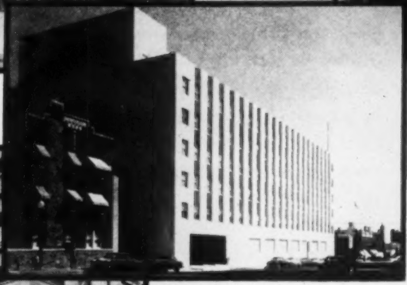
CLIMATE ENGINEERS TO INDUSTRY, BUSINESS AND THE HOME


Electronic Supply Office
Great Lakes, Ill.

Fairview Hospital
Minneapolis, Minn.

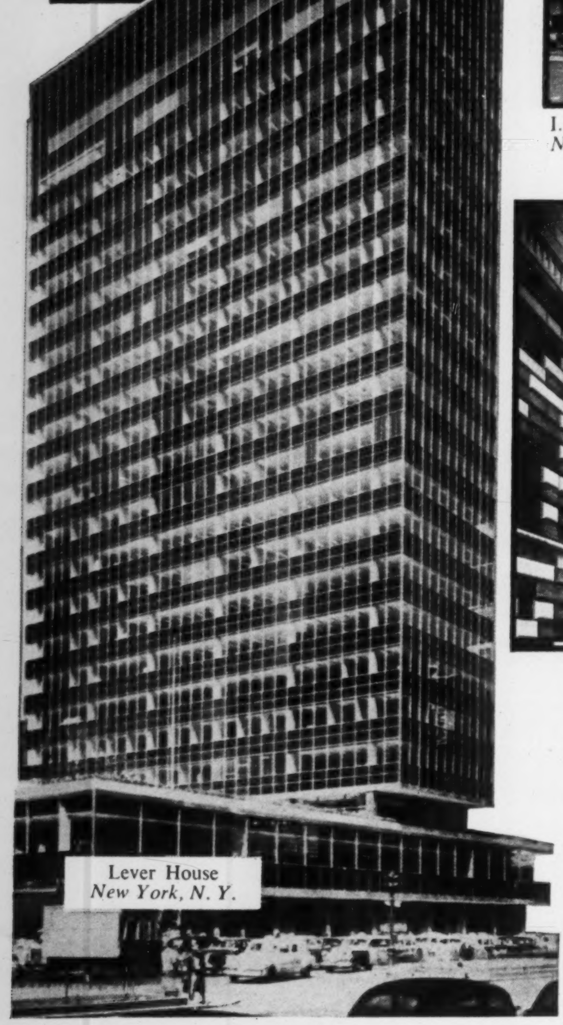


M. H. Lamston
Stores
New York, N. Y.


Sinclair Oil Building
Tulsa, Okla.

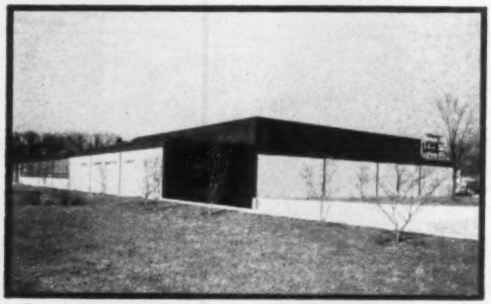
I. B. M. World Headquarters
New York, N. Y.

Dearborn Federal Savings and Loan
Dearborn, Mich.


Lever House
New York, N. Y.

Home Insurance Co.
New York, N. Y.

Decatur Macon County Hospital
Decatur, Ill.


General Telephone Directory Co. *Des Plaines, Ill.*

First National Bank
Little Rock, Ark.

"SOME LIKE IT HOT . . .

SOME LIKE IT COLD . . ."

Tuttle & Bailey High Pressure Units

insure indoor weather that satisfies everybody!

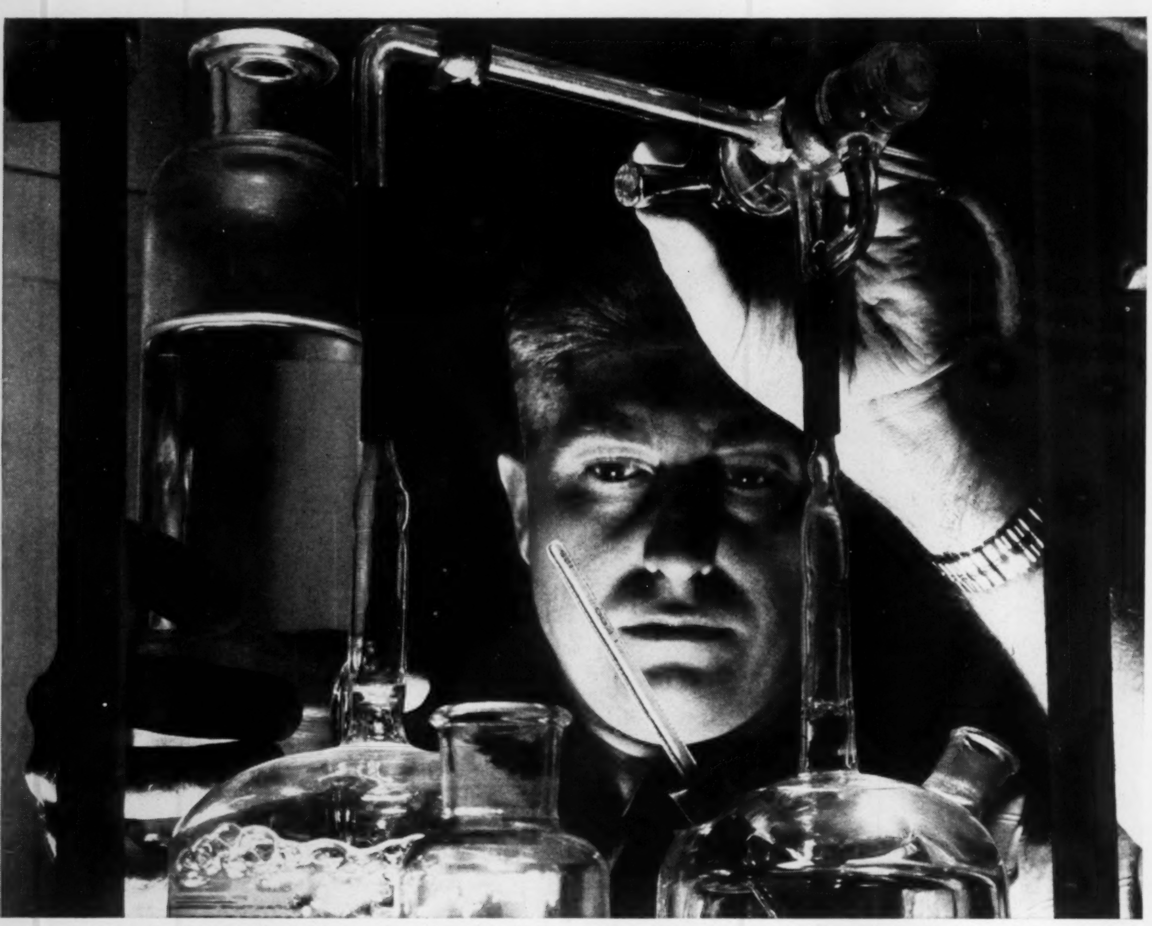
NO TWO of these buildings are alike in architectural concept. Each has an individual cooling and heating problem. But all have one thing in common: in every one of these outstanding buildings, and others like them, Tuttle & Bailey High Pressure Air Distribution Units are providing maximum comfort for occupants, efficiently and economically.

No matter what the system design called for — cooling only, heating only, or a combination of both — the wide range of T & B units permitted selection of equipment to meet the *exact* requirements.

Real savings in overall building and installation costs resulted from the installation of high pressure systems. Conduit risers, and a reduction in the number of supplementary equipment rooms, added much more useable — and rentable — floor space. Conduit branches reduced floor-to-floor dimensions.

For complete information on the advantages of a high pressure air distribution system in new construction or for remodeling, get in touch with your nearest Tuttle & Bailey Representative or write for Catalog No. 109 and Bulletin No. 110.

TUTTLE & BAILEY INC
NEW BRITAIN, CONN.



One reason Westinghouse Air Conditioning lasts longer and requires less maintenance is the Carbon Analysis test shown above. It is performed on all spring steel used for compressor flapper valves. This assures proper balance between hardness and flexibility necessary to prevent valve leakage. It is one of the many tests that result in performance like this . . .

After 17 years—

WESTINGHOUSE AIR CONDITIONING

Compressors Still On Year-Round Schedule

In 1938 the Apponaug Company, Warwick, R. I. installed two Westinghouse Air Conditioning compressors as part of an industrial cooling system. Today, seventeen years later, both compressors are still operating 12 months of the year. Moreover: *these compressors have weathered two hurricanes which completely submerged the units in saltwater.*

And unbelievable as it sounds—only two seals have been replaced during the entire 17 years.

Today Westinghouse compressors are improved—made to last even longer—and require even less maintenance.

HELPFUL GUIDE TO COMPLETE WESTINGHOUSE LINE . . . *Yours for the asking.* Westinghouse offers a handy reference folder showing the complete range of Westinghouse commercial and industrial air conditioning equipment. Covers Unitaire® package units, heat pumps and components for field-assembled installations. For your free copy, write directly to: *Westinghouse Air Conditioning, Dept. HP-4, Box 510, Staunton, Virginia.*

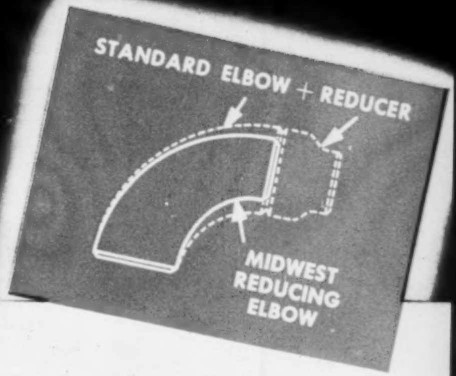
YOU CAN BE SURE...IF IT'S Westinghouse

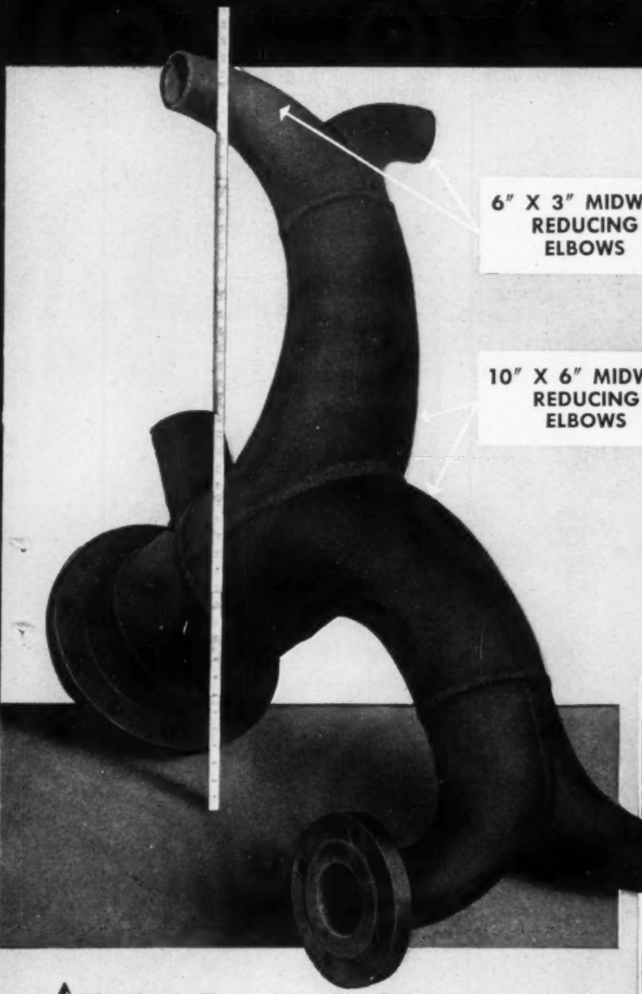
J-80489

Better Piping at a Better Price

by Using MIDWEST

REDUCING ELBOWS

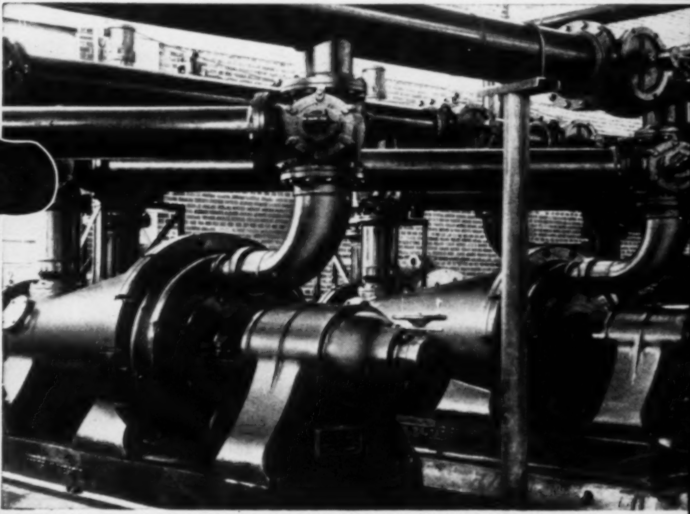



6″ X 3″ MIDWEST REDUCING ELBOWS
10″ X 6″ MIDWEST REDUCING ELBOWS

The Midwest Reducing Elbow offers important advantages in both piping design and piping cost. It needs only two welds instead of the three required by a standard elbow and a reducer (see sketch above). There is also a saving in layout time. Turbulence and pressure drop are reduced by the gradual taper . . . less space is needed . . . insulation is easier . . . and piping appearance is improved.

Only Midwest Reducing Elbows are available from stock in sizes to 16″ . . . larger on special order. They have the same dimensional accuracy, uniformity of wall thickness, exact included angle and true center-to-end dimensions of Midwest Straight Elbows. For further information, ask for Catalog 54.

6999



↑ Midwest Reducing Elbows made it possible to fabricate this transformation piece for a boiler feed suction line so that it could be installed in the limited space available and still get the benefit of streamline flow. There was also a cost saving in comparison with a less efficient and bulky assembly made with straight tees, ells and reducers.

→ Paper stock flows with minimum resistance through Midwest Reducing Elbows from 8″ connection on Jordan to 10″ header. Other advantages over standard elbow and reducer: a saving in cost and space, and improved appearance.

MIDWEST WELDING FITTINGS
Improve Piping Designs
and Reduce Costs

MIDWEST PIPING COMPANY, INC.
Main Office: 1450 South Second Street, St. Louis 4, Mo.
Plants: St. Louis, Passaic, Los Angeles and Boston
Sales Offices: New York 7—50 Church St. • Chicago 3—79 West Monroe St. • Cleveland 14—616 St. Clair Ave. • Los Angeles 33—520 Anderson St. • Houston 2—1213 Capitol Ave.
Tulsa 3—224 Wright Bldg. • Boston 27—426 First St.
STOCKING DISTRIBUTORS IN PRINCIPAL CITIES

Special
Qualities

for all sheet metal work...

WEIRTON
GALVANIZED
STEEL

Whether it's complicated work for a special purpose or an everyday duct job, there's a Weirton galvanized steel to help you do it quicker—and better. Weirton's close control of quality through every step of the production process is carefully planned—and faithfully executed—to assure a tight coat that forms readily, looks better, and resists both peeling and flaking.

So when the job calls for galvanized steel, call Weirton and be sure. Let their experience serve you and your customers—to your profit.

WEIRTON STEEL COMPANY
Weirton, West Virginia
a division of
NATIONAL STEEL CORPORATION

WATERLOO

★ THE COMPLETE LINE OF AIR DIFFUSION EQUIPMENT ★

SINCE 1902

Preferred By Leading Architects, Engineers, Contractors For the Finest

- ★ SCHOOLS
- ★ CHURCHES
- ★ HOSPITALS
- ★ MEDICAL CENTERS
- ★ INDUSTRIAL BUILDINGS
- ★ HOTELS
- ★ APARTMENTS
- ★ RETAIL STORES
- ★ OFFICE BUILDINGS
- ★ THEATRES
- ★ RESTAURANTS

Beauty

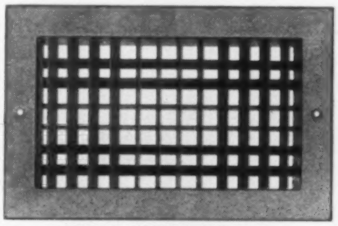
Custom-finished one-piece appearance, with beautiful beveled edge frame, harmonizes with modern interiors.

Efficiency

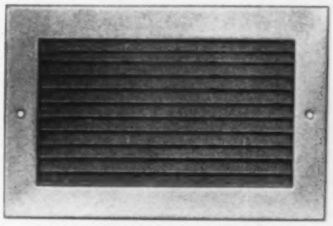
Advanced Waterloo exclusive Louvre design assures perfect air control, with smooth, quiet operation.

Selection

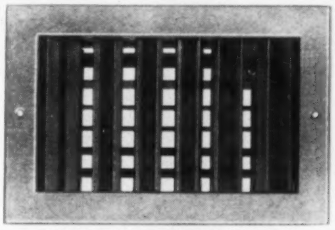
The WATERLOO line is COMPLETE, offering proper air diffusion equipment for ALL air conditioning and heating installations.



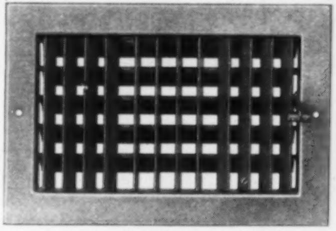
2V SUPPLY GRILLE
Vertical front and horizontal rear louvres. Each individually adjustable for 4-way deflection at degree desired.



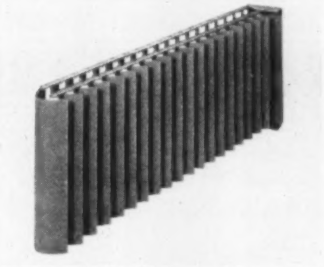
3H RETURN AIR GRILLE
Fixed Fins at 45° or 0° deflection, in heavy gauge steel frame, strengthened with adequately spaced support bars.



2VO SUPPLY REGISTER
Two sets adjustable louvres, vertical and horizontal with opposed damper, vertical blades for even volume control.

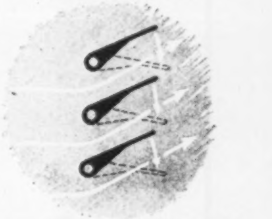


IVMH SUPPLY REGISTER
One set of adjustable vertical louvres for easy adjustment of air, right or left, with multi-shutter damper, horizontal blades.



DUCTROL Air Volume Extractor
Volume controller and extractor, adjusts from full open to full closed, for even distribution to entire grille face.

EXCLUSIVE!



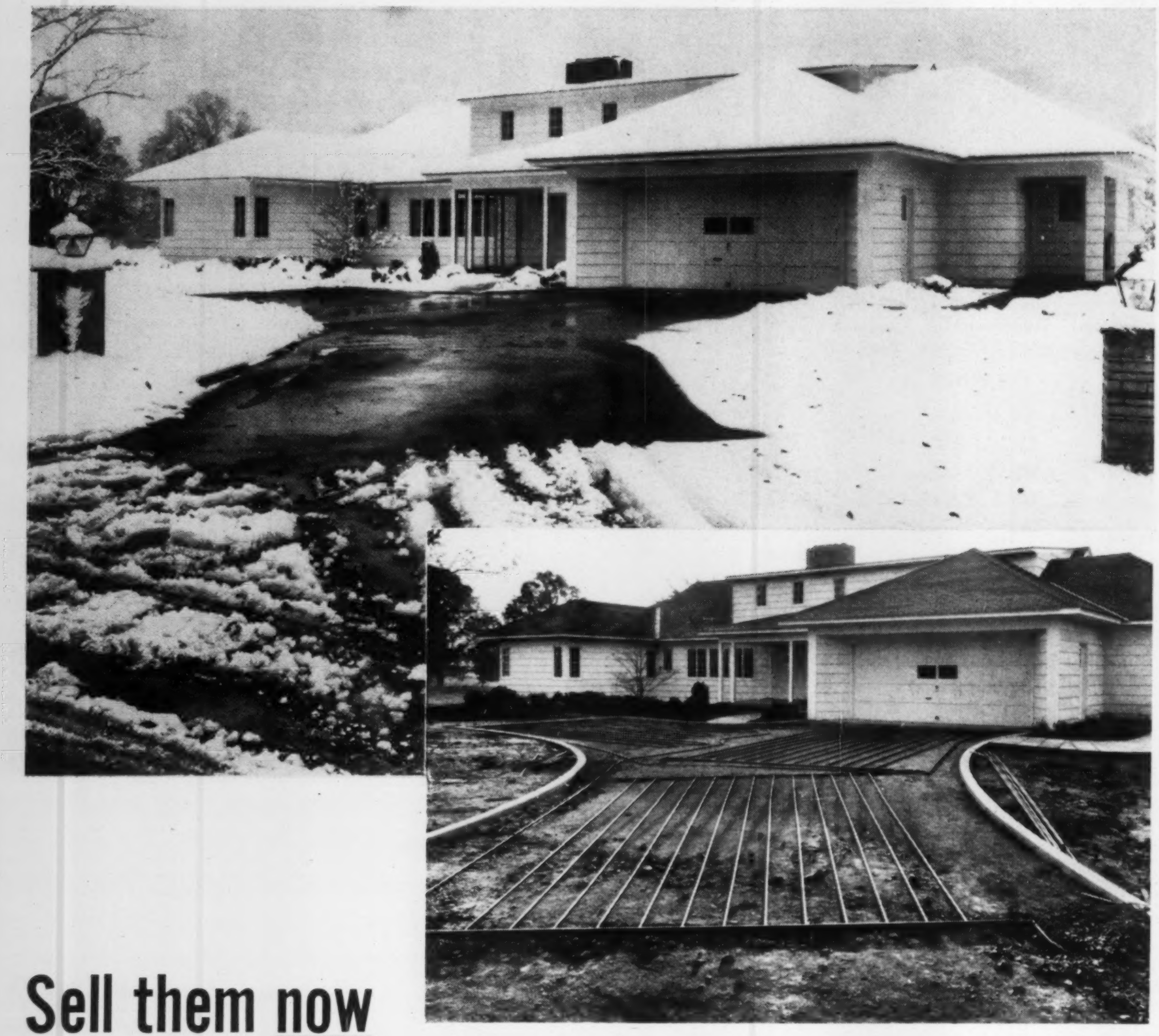
Silent Flow TEAR DROP LOUVRE DESIGN
Provides unobtrusive diffusion with SUFFICIENT SURFACE to turn high velocity air WITHOUT TURBULENCE.

***New* Items have been added in 1955!**
If you have not received your copy, write for supplemental Catalog Insert.

Waterloo AIR DIFFUSION EQUIPMENT

Write for Complete Catalog or Name of Your Local Waterloo Representative

WATERLOO REGISTER CO., Inc.
P. O. BOX 72 WATERLOO, IOWA, U. S. A.



Sell them now on a SPANG® cw steel pipe snow-melting system

This is the season to sell and install snow-melting systems with Spang CW Steel Pipe. Every year more and more of these systems are being installed by stores, factories, clubs, restaurants and home-owners to eliminate the annual snow-removal problem . . . keep sidewalks, driveways and shipping platforms open in any kind of weather . . . build customer goodwill and eliminate accident hazards.

The potential market for snow-melting systems has only been scratched, and you can make a large volume of sales by starting to contact prospects right now! In fact, any industrial or commercial establishment with a torn up sidewalk or driveway is a top prospect, because half the job is already done!

MAKE TOP-QUALITY INSTALLATIONS WITH SPANG CW STEEL PIPE!

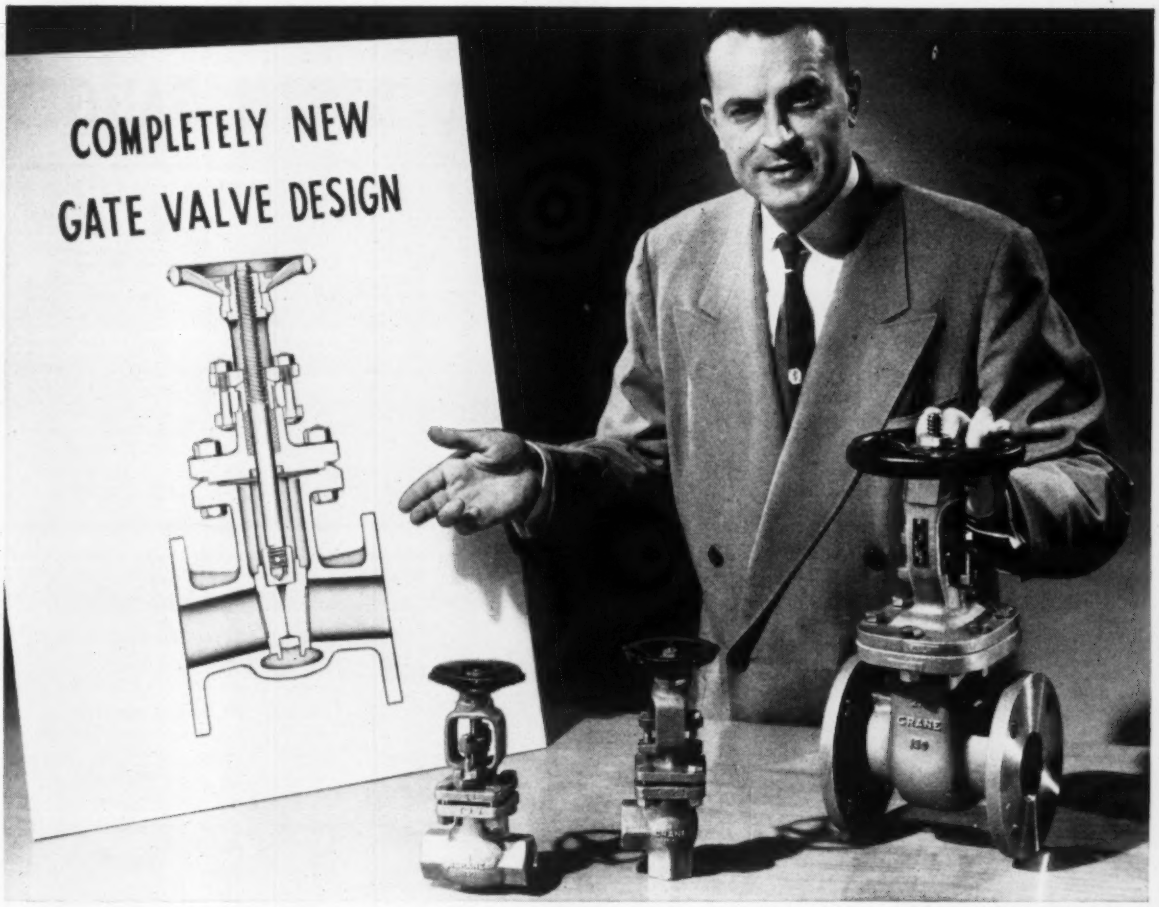
It's tops for snow-melting, because it is manufactured under *quality-control* conditions from the skelp to the finished pipe . . . is thoroughly tested and inspected before shipping. This careful processing makes Spang CW easy to cut, bend, thread and weld, saving you installation time and money. And Spang CW quality features assure you of a *top-quality* installation with years and years of trouble-free service.

GET MORE INFORMATION TODAY!

Let us send you free copies of "Steel Pipe Snow-Melting and Ice-Removal Systems" to help you sell your prospects on a new installation. Start your sales campaign this week. And be sure to specify Spang CW Steel Pipe for every installation! Your nearby Spang Distributor will be glad to help, too.

SPANG-CHALFANT
DIVISION OF THE NATIONAL SUPPLY COMPANY
General Sales Office: Two Gateway Center, Pittsburgh, Pa. District Sales Offices: Atlanta, Boston, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis

SPANG CW STEEL PIPE



New CRANE Corrosion-resistant valves in 18-8 SMo and Craneloy 20

Gate, Globe, Angle and Check Patterns

Few valves for process industries have ever received the quality treatment given this new Crane line—at prices you'll find O.K.

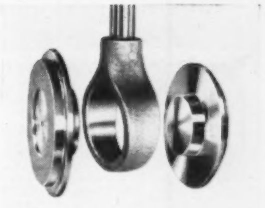
Note, for instance, the unique yet simple split-wedge disc construction in the gate valves. Those dual identical discs are free to rotate in their holder—the most effective design for resisting galling. The trunnion shape at the back of each disc assures even distribution of closing forces. You couldn't buckle them if you tried.

The globe and angle valves give equally outstanding control of corrosive fluids. A new type disc-stem connection, with minimum clearances, practically eliminates vibration. By placing seating load closer to seats, it provides easier, more accurate closure.

Check valves feature compact, thoroughly proved, non-slamming design.

Throughout, these valves are built for better service in your choice of Crane 18-8 SMo Stainless Steel or Craneloy 20. Both lines come with screwed or flanged ends.

ASK FOR THIS CATALOG—Full information including service suggestions given in circular AD-2080—available from your Crane Representative or by mail. Crane Co., General Offices: Chicago 5, Ill. Branches and Wholesalers everywhere.



New split-wedge disc in gate valves combines the benefits of free rotation with uniform seat load pressure.

for the
THRIFTY
BUYER

CRANE CO.

VALVES · FITTINGS · PIPE
KITCHENS · PLUMBING · HEATING

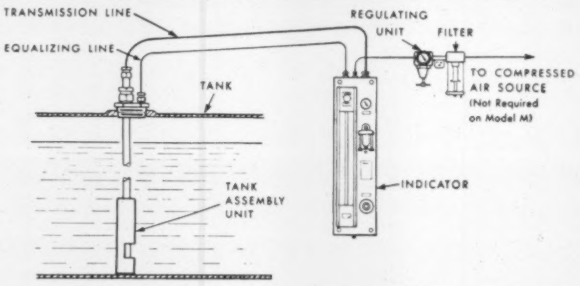
CRANE'S FIRST CENTURY...1855-1955

Petrometer Remote Reading LIQUID DEPTH GAUGES

SERIES 1400

For Accurate, Reliable Measurement of Depth of Liquid in Storage Tanks and Process Vessels. Operates on the principle of hydrostatic pressure... No moving parts... No electrical connections. Gives true reading of contents of tanks above or below the ground.

The Petrometer Industrial Indicating System consists of 5 basic parts: (1) The Indicator, (2) The Tank Assembly Unit, (3) A copper tube transmission line, (4) A copper equalizing line and (5) A manual or automatic source of compressed air for purging the transmission line.



PETROMETER INDUSTRIAL INDICATING SYSTEM

FOUR *NEW* MODELS TO CHOOSE FROM . . .

MODEL 1400 A

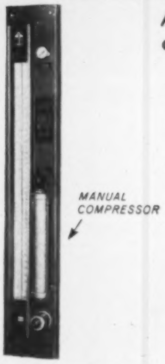
Equipped with aerator valve for semi-automatic indication.

MODEL 1400 B

Equipped with bubbler to give visable evidence of continued aeration. Readings are automatic.

MODEL 1400 F

Equipped with flowmeter in lieu of bubbler.



MODEL 1400 M

Equipped with manual compressor for installations where there is no source of compressed air.

All Petrometer Series 1400 Models, A, B, F and M have these design features:

(1) "Sealed In" Indicating Liquid. Cannot spill during transit.

(2) A one-piece extruded aluminum indicating unit with separate channels for scale and window.

(3) All functional parts are contained on the instrument panel — none on the mounting plate or as separate units.

(4) Easy Installation. Simply mount back cover on wall and plug the instrument panel into the female receptacles for quick-lock fastening.

Send For
Bulletin 6004H

Petrometer

All 1400 Models are obtainable in 8 types for different tank depths.

HOW TO SELECT THE *Right* GAUGE . . .

KEY NUMBER	TYPE	INDICATING FLUID
1 to 64	442	RED-X
65 to 96	443	RED-X
97 to 120	444	RED-X
121 to 144	445	RED-X
145 to 164	446	RED-X
165 to 270	552	MERCURY
271 to 410	553	MERCURY
411 to 520	554	MERCURY
521 to 610	555	MERCURY

To determine the right type:

1. Multiply the vertical depth of the tank in inches by the Specific Gravity of the liquid. This result is the key number.
2. Using the key number select the correct type from the table.

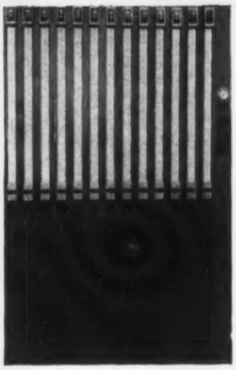
To determine the right model:

1. If compressed air is available select one of 3 models, A, B or F, described above.
2. If no compressed air is available use Model M. Tank assemblies available in brass, stainless steel, Monel, nickel, aluminum, lead, black iron, uscolite plastic. Transmission and Equalizer tubing available in multiples of 10 feet.

MULTI-GAUGE PANEL UNITS

Petrometer Series 1400 Indicators can be obtained in multiple units incorporated on a single panel and mounting plate to meet your specifications. Ideal for central control systems.

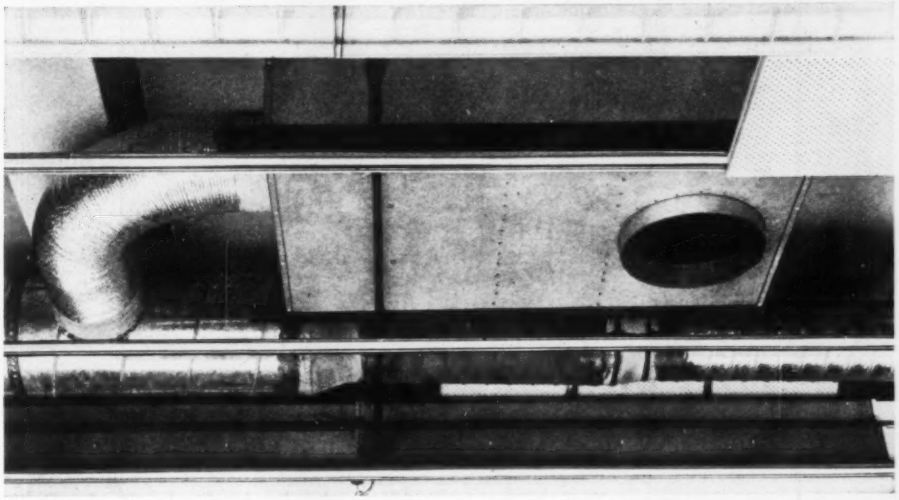
Petrometer Indicating Units, component parts and all accessories can also be purchased separately.



LIQUIDEPTH INDICATORS, INC.

43-22 TENTH STREET **LONG ISLAND CITY 1, N. Y.**

UNION CENTRAL Annex Building, Cincinnati, utilizes some 200 Kno-Draft High Pressure Air Diffusers for quiet, draftless, comfortable air distribution.



BEHIND THE SCENES photo shows typically compact Kno-Draft single-duct system. Note flexible connectors. Outlets at same level as ducts explain why...

High Pressure Saves Space

Space saving, of course, is only one advantage of high pressure air transmission. But it's important. High building costs make it worth while to reduce space allotted to air ducts; and in existing structures, small high pressure ducts have permitted central system air conditioning where space limitations prohibited conventional designs.

Additional advantages of Kno-Draft high pressure systems are: (1) flexibility to meet changes in air conditioning requirements without modifying the system, and (2) individual room temperature control from central station systems.

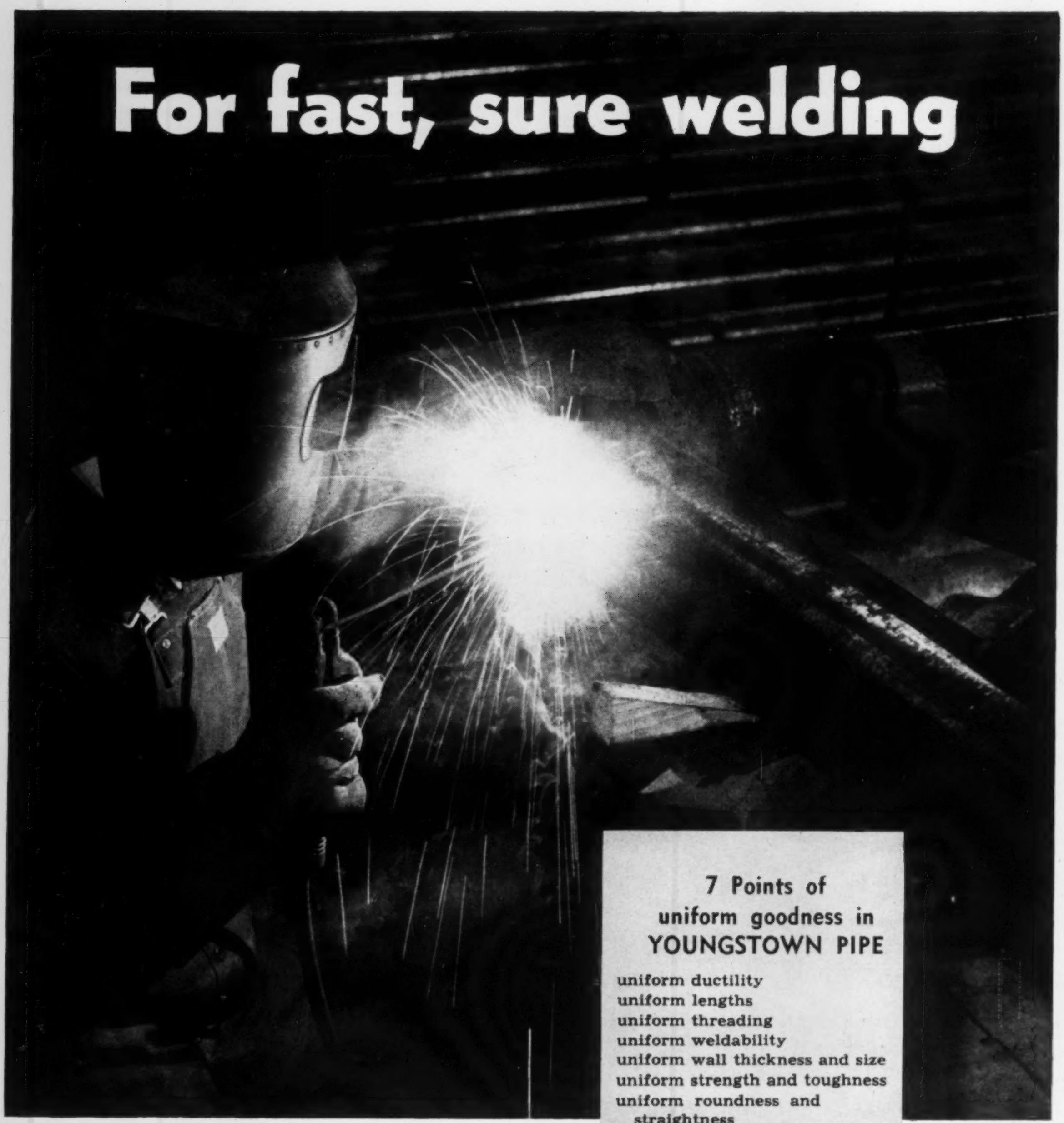
Kno-Draft High Pressure Air Diffusers are especially designed to handle air at branch duct velocities up to 3,000 feet per minute. Outlets are equipped with dampers and sound traps to eliminate noise. System provides even temperatures throughout the area *without drafts.*

For a full description of Kno-Draft High Pressure Air Diffusers and layouts for typical systems, read the Connor textbook on the subject. Write on your letterhead for a copy of Bulletin K33. Connor Engineering Corporation, Dept. G-75, Danbury, Connecticut.

see our catalog in
ARCHITECTURAL FILE
or write for copy

CONNOR
ENGINEERING CORPORATION

kno·draft®
adjustable air diffusers



7 Points of uniform goodness in YOUNGSTOWN PIPE

- uniform ductility
- uniform lengths
- uniform threading
- uniform weldability
- uniform wall thickness and size
- uniform strength and toughness
- uniform roundness and straightness

●This man is position-welding an expansion joint in a steam line. Only good steel pipe like Youngstown takes this type of weld easily. That's because top-grade steel bonds better and faster. Depend on Youngstown and you're hours of labor ahead.

Youngstown

QUALITY YOUNGSTOWN SERVICE

THE YOUNGSTOWN SHEET AND TUBE COMPANY *Manufacturers of Carbon, Alloy and Yoloy Steel*

General Offices: Youngstown, Ohio - Export Office: 500 Fifth Avenue, New York 36, N. Y.

SHEETS - STRIP - PLATES - STANDARD PIPE - LINE PIPE - OIL COUNTRY TUBULAR GOODS - CONDUIT AND EMT - MECHANICAL TUBING - COLD FINISHED BARS - HOT ROLLED BARS - BAR SHAPES - WIRE - HOT ROLLED RODS - COKE TIN PLATE - ELECTROLYTIC TIN PLATE - RAILROAD TRACK SPIKES

The USS Forrestal—

another example of how Walworth helps protect a 200 million dollar investment

Walworth products installed aboard the *USS Forrestal* include gate, globe, and lubricated plug valves and pipe fittings. They are used on high pressure air lines, fire mains, and most of the other piping systems throughout the ship.

Thousands of Walseal® Bronze Valves, Fittings, Flanges, and Unions comprise the major portion of the Walworth installations.

Walseal is a registered trade mark which identifies valves and fittings manufactured by the Walworth Company. Walseal products have *factory-inserted rings* of silver brazing alloy in threadless ports. Walseal joints can be made only with Walseal valves and fittings.

WALWORTH

valves . . . pipe fittings . . . pipe wrenches

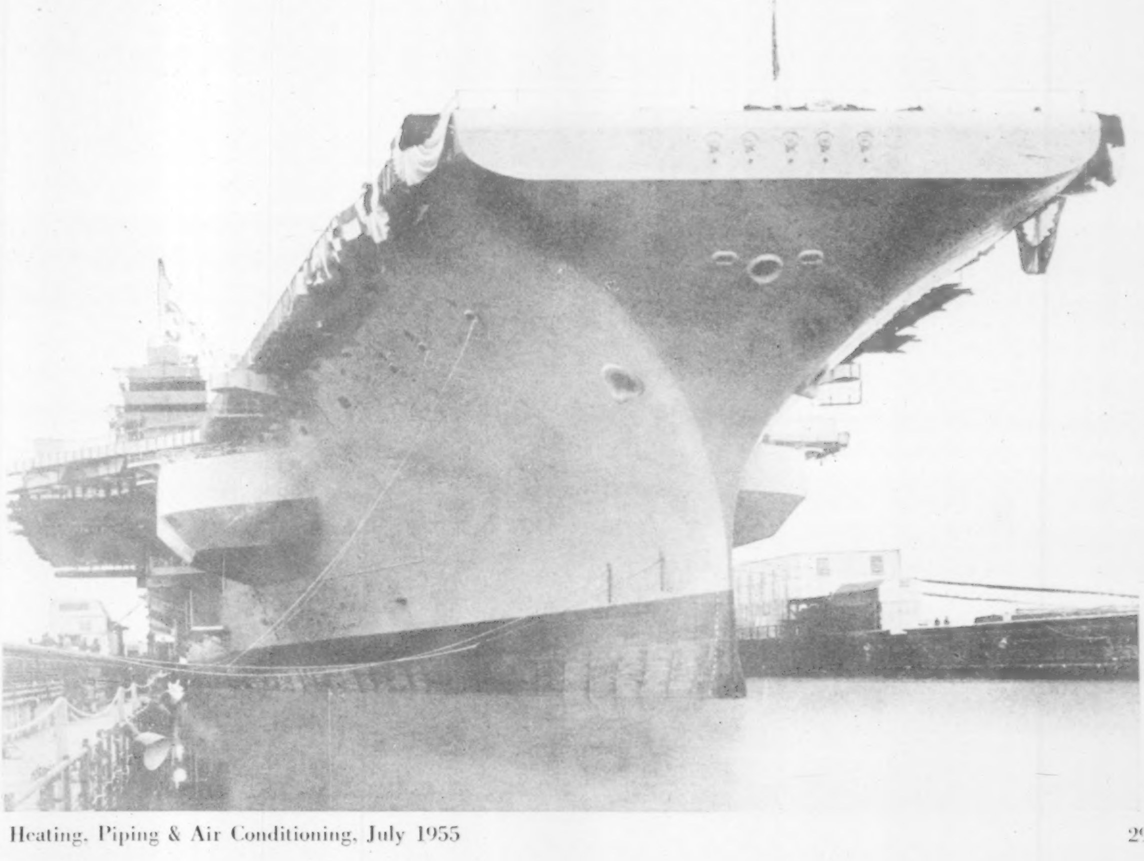
60 East 42nd Street, New York 17, N. Y.
Walworth Company of Canada, Ltd., Toronto

Keel laying to launching—Walworth was there.

Walworth engineers worked with designers, metallurgists and builders of the mighty flat-top right from the blueprint stage. Their efforts assured the builder — Newport News Shipbuilding and Dry Dock Company — that *every* Walworth Valve and Fitting installed would meet *every* specification right down to the finest detail.

The *Forrestal* — like the *USS Nautilus*, the first nuclear-powered submarine — is another striking example of where Walworth engineering and products were called upon to protect a multimillion dollar investment.

Walworth, backed by 113 years of practical valve experience, is skilled in every type of installation. Whatever the industry, if your problem concerns valves or fittings, it will pay you to call on Walworth! Distributors in principal cities throughout the world.



FEATHER LIGHT

In many heat exchanger applications, units must be lightweight, small, low in cost. At the same time, they must be dependable and efficient.

Wolverine makes all of these unique requirements possible with a tube specifically engineered for today's economy-minded condenser designs. It is called Wolverine Trufin* Type L/C.

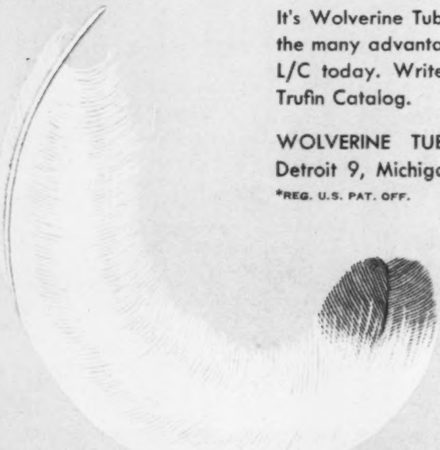
This tube is bi-metal with an integral finned exterior of feather light aluminum and a liner of corrosion-resistant copper or copper base alloy. Wolverine produces it in a wide range of sizes.

Unusual? Yes! Costly? No!

It's Wolverine Tubemanship at work! Look into the many advantages of Wolverine Trufin Type L/C today. Write for a copy of Wolverine's Trufin Catalog.

WOLVERINE TUBE, 1461 Central Avenue, Detroit 9, Michigan.

*REG. U.S. PAT. OFF.



WOLVERINE TUBE
DIVISION OF CALUMET & HECLA, INC.
Manufacturers of Quality-Controlled Tubing
and Extruded Aluminum Shapes

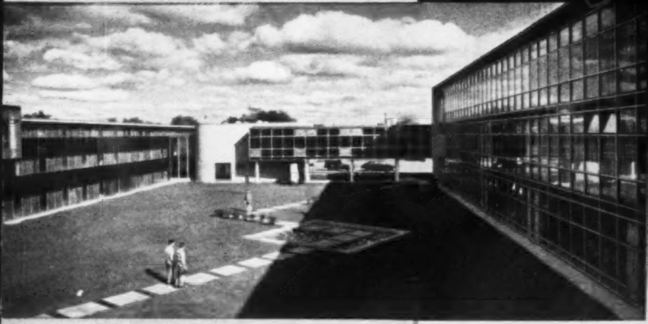
EST. 1916

Wolverine Trufin is available in Canada through the Unifin Tube Company, London, Ontario.

PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA • SALES OFFICES IN PRINCIPAL CITIES
EXPORT DEPT., 13 E. 40TH ST., NEW YORK 16, N.Y.

ST. PATRICK HIGH SCHOOL, CHICAGO

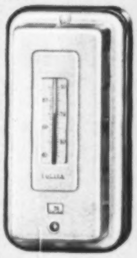
Architects: Belli & Belli ● **Engineers:** W-B Engineering Co. ● **Contractors:** W. T. Mahoney & Sons, Inc.; **Plbg.**, L. J. Keefe Co.



ST. PATRICK
HIGH SCHOOL

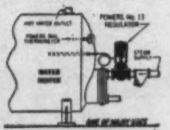
Quadrangle with reflecting pool. Faculty building left facing south has blue porcelain enamel panels, clear glass and blue green fibre glass drapes. Chapel, in center, with plastic sky domes is connected by stained glass cloister to school building right. North exposure of the school has clear glass and gold colored fibre glass drapes.

Dramatic 70 ft. high cross at main entrance is stainless steel. Drapes behind clear glass windows are blue green fibre glass. Yellow terra cotta panels have religious insignia in black. Colors thruout the buildings including the gym are attractive.



Gymnasium type guard for thermostat

No Danger of Scalding Showers, Water Economy, too is obtained with Powers Thermostatic Control for 50 showers.



No Losses from OVER-heated Water.
Hot water generator also is Powers Controlled.

POWERS Automatic Temperature Control

Is Used Throughout this Colorful Modern School

for the Heating and Ventilating System, Hot Water Generator and Shower Baths

Utmost Fuel Economy, Thermal Comfort and Convenience are assured here with a Powers Control System. Users often report 25 to 50 years of reliable service with a minimum of repairs.

For more than 60 years the name POWERS has stood for quality temperature control, proper installation and SERVICE if required.

Next time a problem of temperature or humidity control arises call POWERS. No other single firm makes a better line of thermostatic controls for heating, air conditioning, hot water generators and all types of shower baths.

POWERS CONTROL

THE POWERS REGULATOR COMPANY

SKOKIE, ILL. • *Office in Chief Cities in the U.S.A., Canada and Mexico*

Over 60 years of Automatic Temperature and Humidity Control

FRICK TRADE MARK®

Air Conditioning

SERVES THE CLARIDGE HOTEL AT MEMPHIS 21 YEARS!

Back in 1934 the Coffee Shop and Twentieth Century Ball Room at the Claridge were among the first in Memphis to be air conditioned. Two years later a Frick ice-making system was installed, and in 1941 additional cooling capacity for air conditioning. Now the top nine floors have been given the benefit of Frick air conditioning.

What a boon to guests and staff, alike! And what a tribute to Frick equipment, which cools the entire 15-story building! Seven Frick heavy-duty compressors carry the load.

Whether you operate a hotel, restaurant, hospital, store, office, or industrial plant, there's a Frick air conditioning system to meet your exact needs. Also refrigerating, ice making and quick-freezing equipment in all commercial and industrial sizes. Our complete engineering, manufacturing, installation and maintenance service is offered alike to owners and to engineer-contractors. Get literature and estimates now on dependable Frick air conditioning and refrigeration. Visit, phone or write

Frick Bulletin 504 features general air conditioning; 505 shows engineering details of Frick systems; 522 describes Frick unit air conditioners. See also the Frick pages in Sweet's Catalogs.

DEPENDABLE REFRIGERATION SINCE 1882

FRICK Co.

WAYNESBORO, PENNA. U.S.A.

New! Designed for Modern Industry

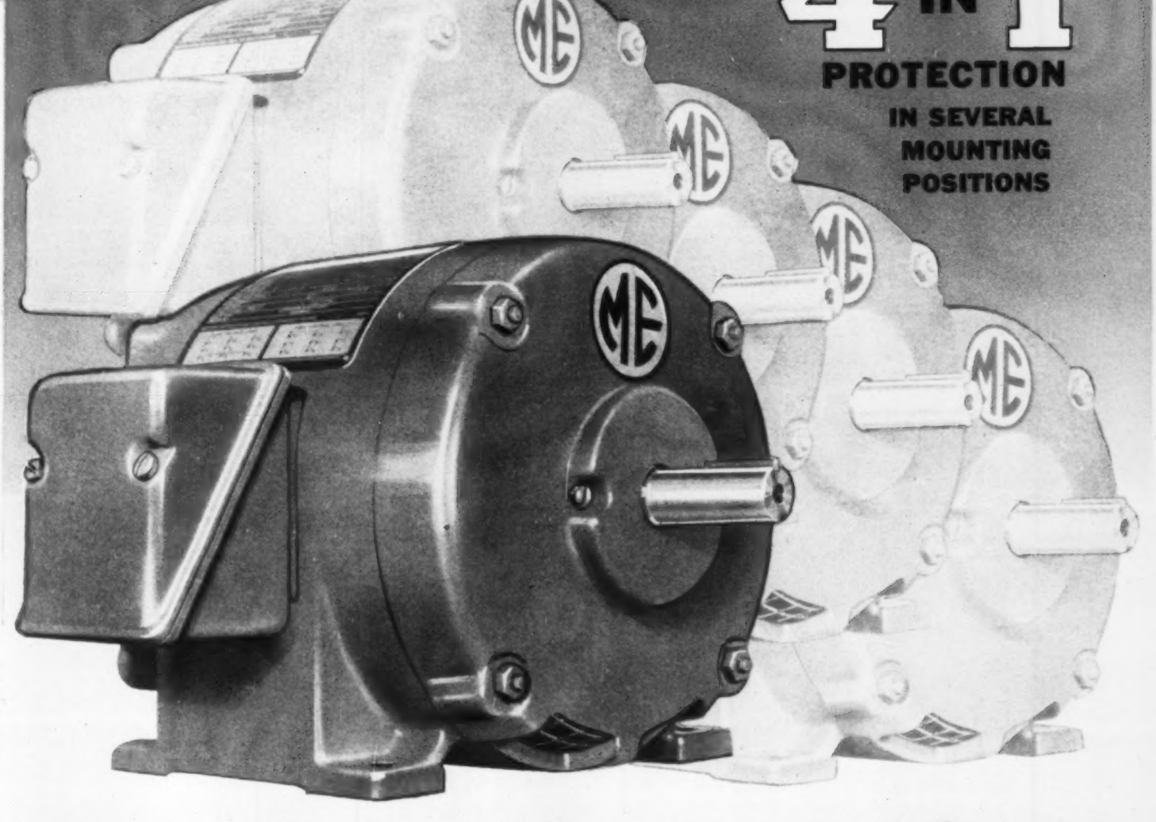
VERSATILE

INTEGRAL HP MOTORS

4 IN 1

PROTECTION

IN SEVERAL
MOUNTING
POSITIONS



① DRIPPROOF ② SPLASHPROOF ③ WEATHER PROTECTED ④ GUARDED

VERSATILE
INTEGRAL HP MOTORS

For the Whole Story
Write for ME Bulletin SB-155

Marathon Electric serves many varied industries with its wide range of

Motors - $\frac{1}{20}$ - to - 2500 H. P.
Generators - $\frac{1}{2}$ - to - 2000 K. W.

This 4 in 1 design for variable mounting is available in cast iron frames.

Your product can be improved by the adaptability of these motors.

THE PRODUCTION
ENGINEERING
SHOW
Navy Pier, Chicago
September 6-16, 1955

SINCE 1913

MARATHON ME ELECTRIC

HOME OFFICE AND FACTORY, WAUSAU, WIS.

FACTORIES AT ERIE, PA. AND EARLVILLE, ILL.

SALES OFFICES IN PRINCIPAL CITIES

Step Up to the Best

Step Up to
genetron®
Super-Dry
REFRIGERANTS

When you step up to a counter with the bright green "Genetron" counter mat on it, you know you've stepped up to the best refrigerants money can buy. You know you're dealing with a progressive wholesaler who looked over the field and chose "Genetron" Super-Dry Refrigerants as the brand to offer you.

No wonder! In "Genetrons," you will be getting dependable refrigerants that are:

- **Super-Dry: guaranteed exceptionally low moisture content.**
- **Non-corrosive to standard equipment materials.**
- **Non-toxic, non-flammable, stable, safe.**
- **Critical and freezing points are well outside range of operating uses.**
- **Solvent action on oil helps prevent solidification or congealing of lubricant.**
- **Miscible with oil; aid in lubrication of equipment.**

Order today—from the man with the bright green "Genetron" mat on the counter!

genetron® 12—WHITE LABEL
DICHLORODIFLUOROMETHANE

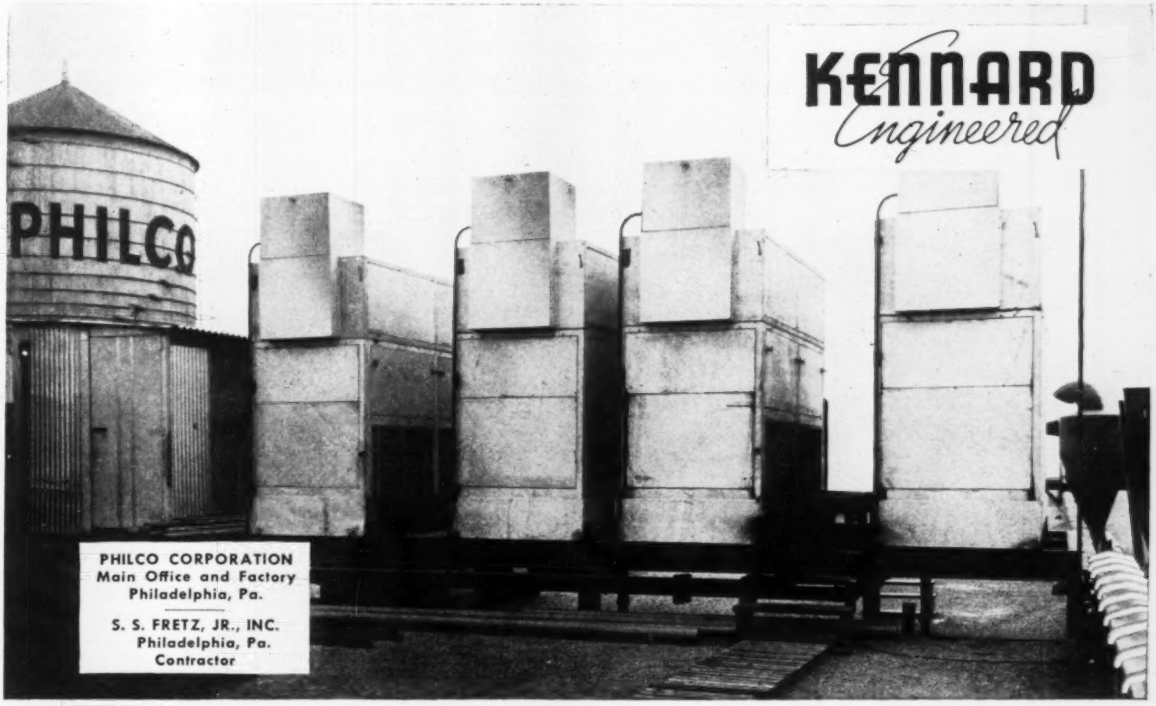
genetron 141—GREEN LABEL
MONOCHLORODIFLUOROMETHANE

genetron 11—ORANGE LABEL
TRICHLOROMONOFLUOROMETHANE

"Genetron" Super-Dry Refrigerants are Products of

GENERAL CHEMICAL DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

Allied Chemical



KENNARD *Engineered*

PHILCO CORPORATION
Main Office and Factory
Philadelphia, Pa.

S. S. FRETZ, JR., INC.
Philadelphia, Pa.
Contractor

Four
75 TON COOLING TOWERS

The Philco Corporation, with its great store of engineering knowledge, selected Kennard Cooling Towers.

Kennard Engineered Cooling Towers are built in 8 sizes—from 15 to 75 tons. Durably built, generously proportioned, designed for maximum service and accessibility.

Compare before ordering, and you too will select Kennard:

- Completely corrosion proofed, hot-dipped Galvanized (after fabrication) wheels and scrolls, sump, blower section and panels. Stainless Steel or Bronze fastenings used throughout.
- Quiet, long-lived operation, efficient fan selections, moderate tip speeds and outlet velocities, oversize bearings and shafts.
- Sectional construction; Door-way-sized sections permits easy building access.
- KENNARD "Penta-Post" construction of frame members allows maximum number of access and service panels.
- Counter flow of the air and water spray and complete intermixing of the two over the generous wetted deck surface.
- Indoor or Outdoor.

Representatives in All Principal Cities

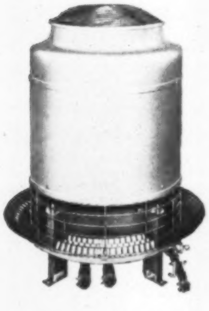
HOME OR BUSINESS

Kennard KT Cooling Tower—Engineered for long life. Centrifugal fan, vertical air discharge, Redwood wetted deck, Galvanized construction throughout. Brass and Bronze trim. Compact and quiet to place in your home. Efficient and rugged for outdoor commercial use.

In Stock—Order Yours Now

Indoor or Outdoor—sized to meet your requirements. 3, 5, 8, 11 and 16 ton capacities. **Ask for Catalog KT-2.**

DESIGNED FOR THE HOME

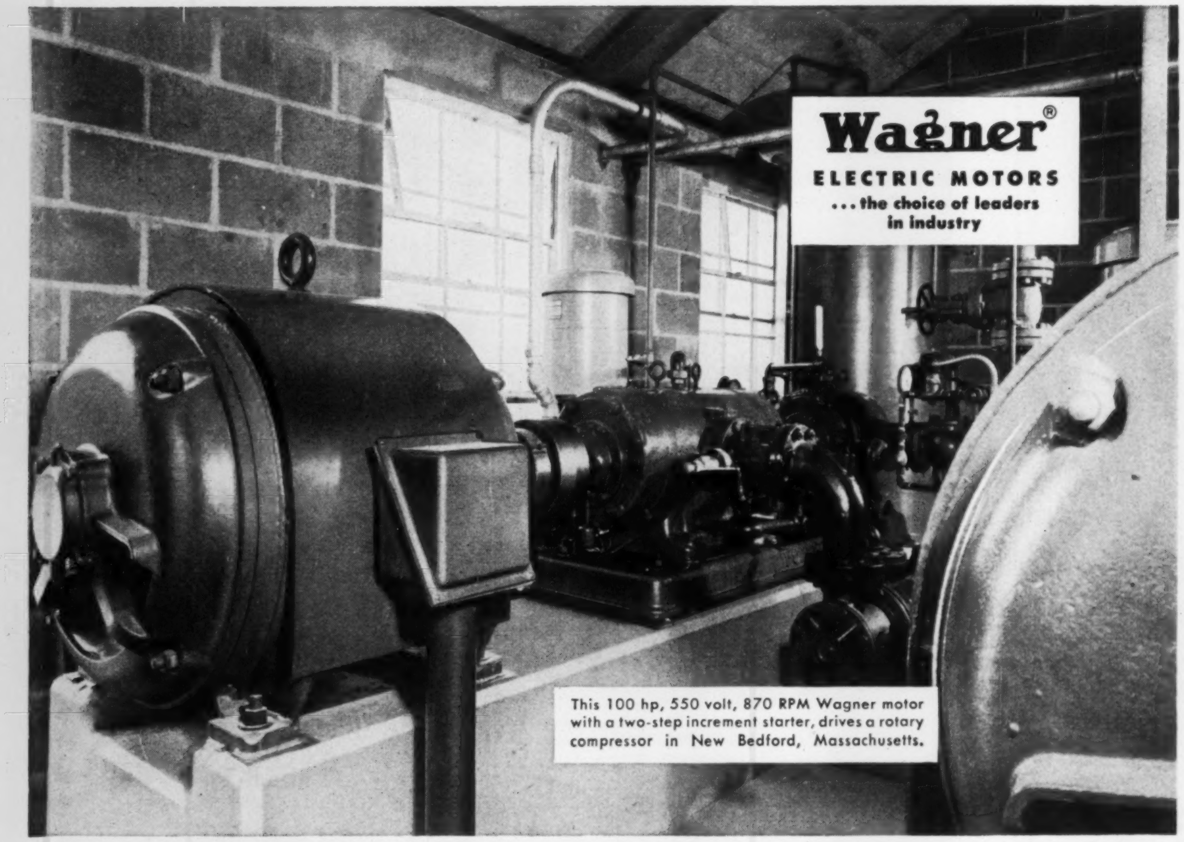


The All New Water Saver QT COOLING TOWER

WATER TURBINE DRIVEN fan eliminates electrical connections to the tower and unsightly outdoor wiring and reduces installation costs to a minimum. The FIBERGLASS REINFORCED PLASTIC cabinet and sump pan, combined with clear heart of redwood deck and Stainless Steel grilles, makes it the most corrosion resistant tower available.

Pleasing green color (never requires painting), low in height (42"), vertical air discharge, safe for children and pets. Install outdoors. Sizes 3 & 5 ton. **Ask for Catalog QT-2.**

KENNARD CORPORATION
1817 S. HANLEY RD. • ST. LOUIS 17, MO.



This 100 hp, 550 volt, 870 RPM Wagner motor with a two-step increment starter, drives a rotary compressor in New Bedford, Massachusetts.

Start large polyphase motors with minimum line voltage disturbance

USE THE Wagner INCREMENT MOTOR AND STARTER COMBINATION

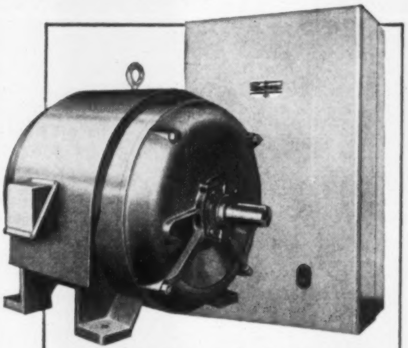
Here's a modern, economical, highly efficient way to start large polyphase motors — the Wagner Increment Motor and Starter "Package."

By reducing current drawn from the line on each point of the starter, the combination limits the inrush of motor current to values that are acceptable for the distribution systems of most power companies.

Voltage disturbances on the line are reduced because current taken from the line is not broken during the starting period—as it is when autotransformers or compensator type starters are used.

Wagner two-step increment motor and starter combinations are suitable for most applications. For installations where unusually low inrush of starting current is desired, Wagner can furnish three-step and four-step increment starters.

Your nearby Wagner engineer will help you select the increment motor and starter combination that meets *your* requirement. Call the nearest of our 32 branch offices, or write us.



Type RP polyphase motor in ratings to 400 hp with increment type starter

Wagner
Electric Corporation
EST. WEC 1891

Wagner Electric Corporation
6370 Plymouth Ave., St. Louis 14, Mo., U. S. A.

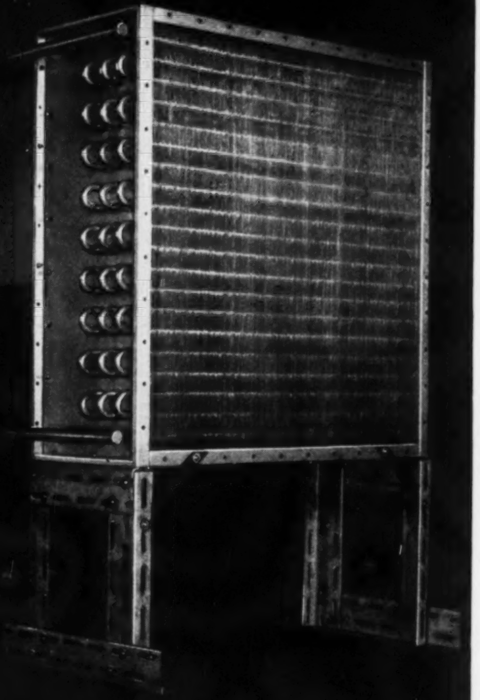
BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

M55-16

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS–AIR AND HYDRAULIC

PEERLESS Hi-F *(High Efficiency)*
AIR COOLED CONDENSER

NO-WATER



Hi-F Air Cooled Condenser for mounting in stand on roof or remote outside location—also indoor installations with discharge duct to outside. Low Cost. ELIMINATES USE OF WATER. ¾, 1, 1½, 2, 3, 5, 7½ and 10 ton capacities.

Peerless is a name that dates back to the pioneer days of finned coil manufacture. With this background of experience it is no wonder that to "oldsters" in the industry and "newcomers" as well, the name Peerless stands for integrity.

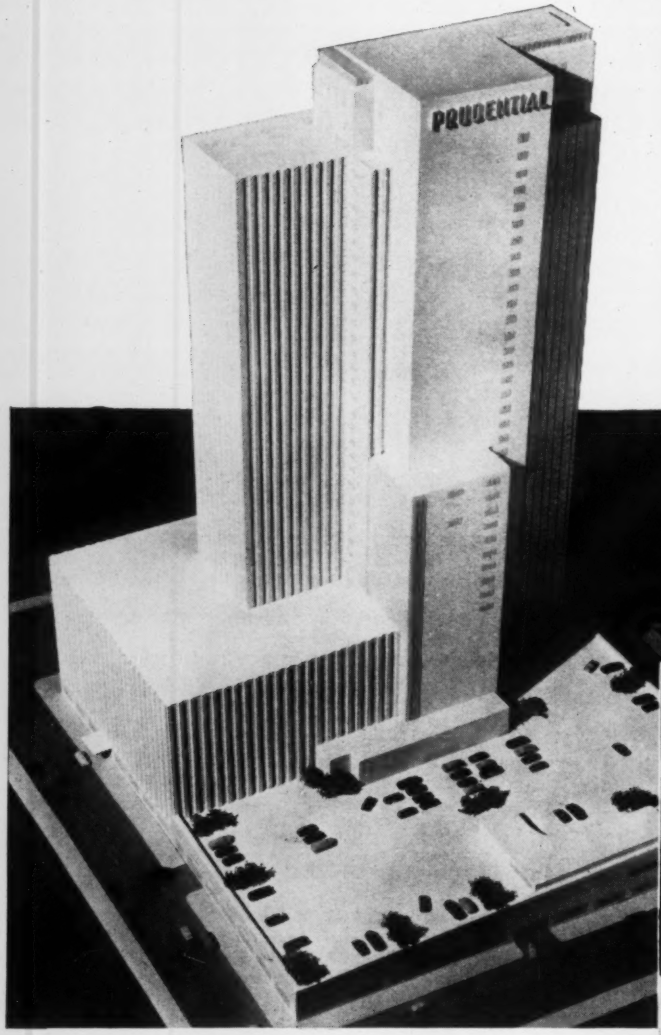
The Hi-F Air Cooled Condenser is the culmination of years of know-how reflected in a design that assures maximum B.T.U. capacity season after season. In addition, the new and exclusive patent-applied-for Peerless manufacturing process is so efficient and rapid in operation that on time delivery is assured to any contractor even under emergency conditions.

Write for Bulletin No. NW 155 containing full engineering information on the Hi-F Air Cooled Condenser.

MANUFACTURERS, NOTE—*Send us blue prints of your evaporator and condenser requirements for a Hi-F quotation. Please indicate delivery requirements.*

PEERLESS OF AMERICA, INC.
Dept. H, 5830 N. PULASKI ROAD, CHICAGO 30, ILL., U.S.A.

Prudential "takes out insurance" on safety and dependability with USS NATIONAL PIPE



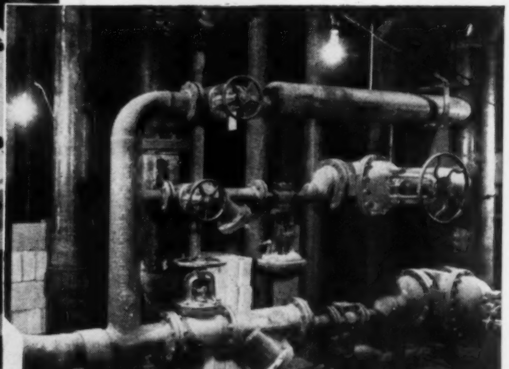
The new Prudential Building, Chicago, Illinois.

The Prudential Insurance Company of America adopted the policy of installing nothing but the best in their new Chicago office building. That's why almost 200 tons of National Steel Pipe were used in the construction of the ultra-modern skyscraper. Here's how the material was used:

- Approximately 120 tons of National Seamless, ranging in diameter from 6 inches to 20 inches, were employed as air conditioning carriers. These "risers" run from the sub-basement to the top floors.
- About 42 tons of National Seamless, ranging from 2 inches to 14 inches in diameter were used for heating and fan rooms.
- About 20 tons of National Pipe, from 1 inch to 3 inches in diameter, help make up the building's plumbing system.

It's no surprise that National Pipe is used in so many of the "big jobs" across the country. Engineers know from past experience that they can depend on National for safe, efficient, trouble-free service.

Write us for further information on the use of National Pipe in air conditioning, heating, and power installations. And, if you'd like some personal assistance with your pipe problems, get in touch with our engineers.



NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

NATIONAL STEEL PIPE

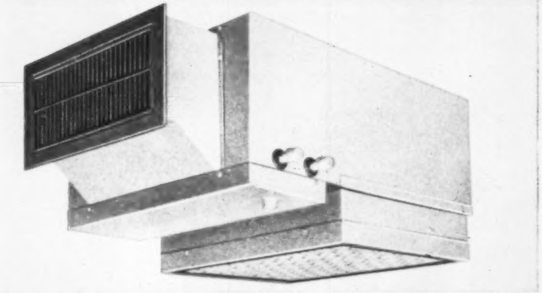
USS

UNITED STATES STEEL

Don't do anything until you investigate this

New Air Conditioner

FOR MOTELS, HOTELS, RESIDENCES, OFFICES

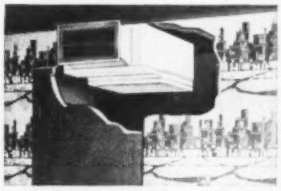


RECOLD Model *RE*

It's Quiet

Cools • Heats • Dehumidifies • Filters

Available for direct expansion systems or chilled and hot water systems. Ideal for multiple installations. Each unit individually controlled for personalized comfort.



Easy to Install

Fits almost anywhere with minimum effort. No ducts. No sheet metal work. Unit is completely enclosed.

Easy to Service

Anyone can remove or replace the filter or the plug-in motor unit in seconds without tools.

No Buzzing

No Drumming

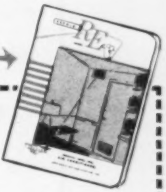
No Whistling

Inexpensive, Efficient, Versatile

Recold *RE* solves room air conditioning problems quickly, efficiently, inexpensively. Priced far below comparative units. Saves on installation, too. Comes complete, including electrical connection box. Easily installed almost anywhere in new or existing buildings. Fits into unused area such as space above closet shelf. Outlet fits between studs. Recold *RE* gives you three big advantages: low first cost, low installation cost, low maintenance cost.

Specify Recold *RE* Air Conditioners.

Write for illustrated folder



Recold

Refrigeration Engineering, Inc.
7250 East Slauson Avenue
Los Angeles 22, California

RECOLD

REFRIGERATION ENGINEERING, INC.
Dept. G-1
7250 East Slauson Avenue
Los Angeles 22, California

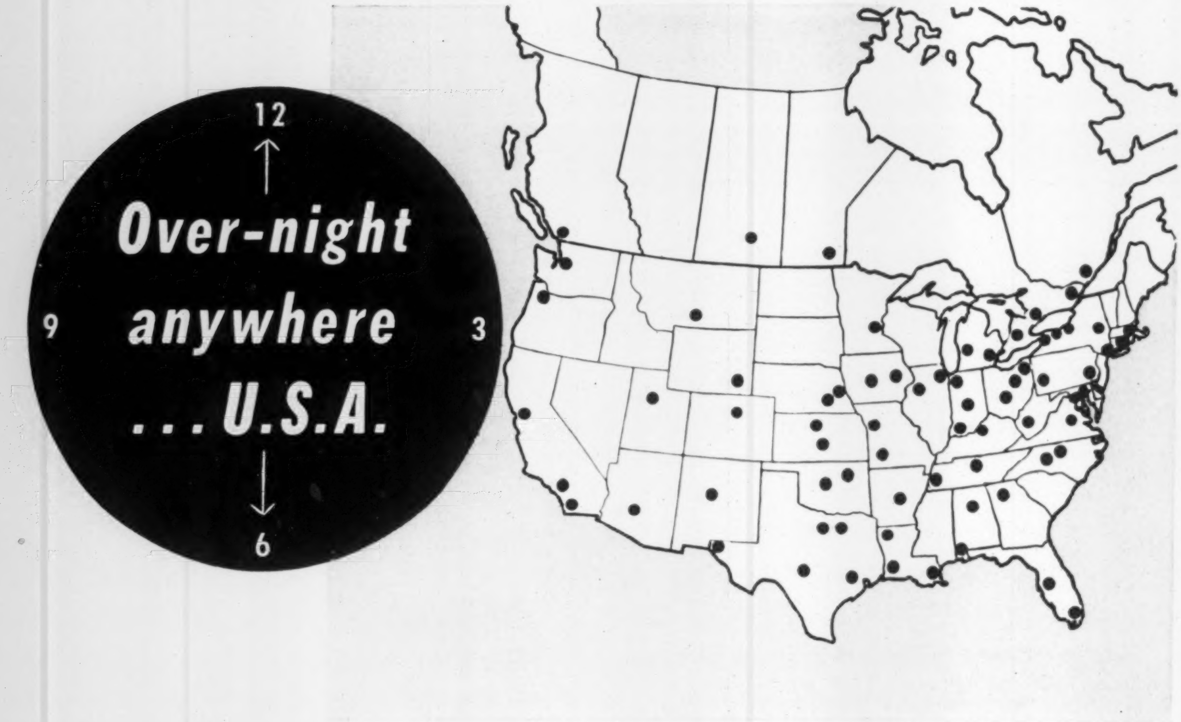
Please send illustrated folder on the Recold RE Air Conditioner.

NAME ____________________

FIRM ____________________

ADDRESS ____________________

(or attach to your letterhead)



JENN-AIR **LOW-CONTOUR** exhausters

66 Distributors—Coast-to-Coast—Insure Fast Delivery and Service

In these days when speed's the need in building, it's good to know you can depend on fast delivery and service with Jenn-Air Low-Contour Exhausters . . . 66 distributing offices coast-to-coast mean over-night service anywhere in the U. S. A. And since Jenn-Air is the largest manufacturer of wall and roof exhausters in the commercial ventilation field, you can specify with confidence when you select Jenn-Air. So, if you're faced with a close building schedule, select Jenn-Air, and be assured your ventilating installation will be made on time and in time.

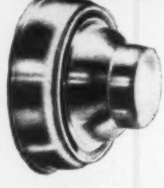
Jenn-Air, First with Low-Contour Exhauster Design

Jenn-Air is the originator of truly "low contour" exhauster design. In considering contour, two levels are important; the discharge level height, which must be sufficient to be above snow or blowing rain, and the over-all level height, which should be low enough to provide true low contour.

Jenn-Air Roof Exhausters with the nesting feature (power assembly nested into base of unit) give a high point of discharge near the top of the unit and still retain the lowest possible contour. In addition Jenn-Air provides a pleasing architectural effect. Write for the name of your closest Jenn-Air distributor.

Jenn-Air — World's Largest Producer of Commercial Wall and Roof Exhausters

Low-contour Roof Exhausters blend with architectural design of building

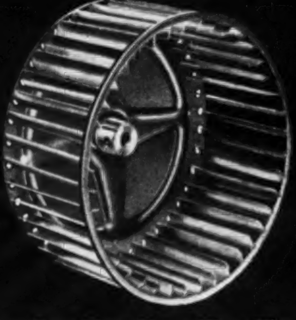


Wall Exhausters—architecturally sculptured button design spots ventilation control

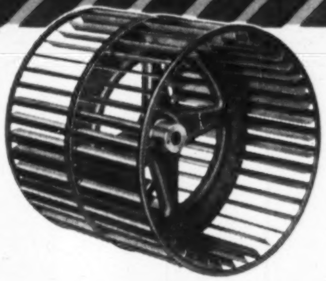
JENN-AIR PRODUCTS COMPANY, INC.
Architects & Builders Building • Indianapolis 4, Indiana

LEADERS RELY ON LAU

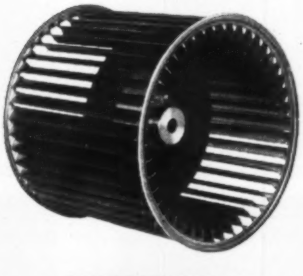
FOR SUPERIOR SPECIALIZED BLOWER WHEELS



Single Inlet
Double Inlet
Center Suspended
Spun Wheels
Riveted Wheels



Lau is the **complete** Wheel line for air-handling equipment manufacturers, distinguished by the industry's most advanced engineering and design features incorporated into the sturdiest possible construction. If you manufacture oil or gas-fired furnaces, oil burners, air conditioners, refrigeration, or automotive equipment utilizing Blower Wheels . . . you'll find the Wheel of the exact size and type in the **Lau** line, to fit every requirement at very reasonable cost.



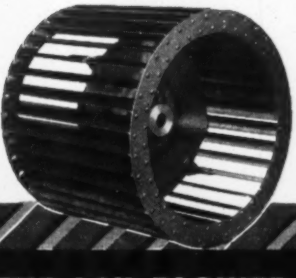
SIZES
1¾" to 30" width
4¼" to 30" diameter

BORES
¼" to 3½"

CAPACITY RANGES
50 to 22,000 cfm
0" to 2" static pressure

FINISHES
Baked Aluminum Enamel
Hot-Dip Galvanize • Ruspruf

Standard Steel or Power Lock Hubs



Put your Problems up to Lau

We specialize in production tooling of highest quality at low cost. If you need special Wheels, contact **Lau.** Ask for **Lau** Blower Catalog 707.

LB-4-55

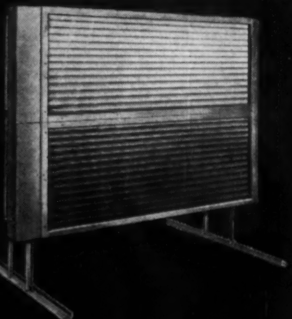
THE LAU BLOWER COMPANY • 2112 Home Avenue, Dayton 7, Ohio

In Canada • The Lau Blower Company of Canada, Ltd., Kitchener, Ont., Canada

INDOOR COMFORT

LAU World's Largest Manufacturer of Air Conditioning Blowers

STOP *using water!*



Eliminate all water problems with UNICON by KRAMER. Any size compressor, regardless of tonnage, can be air-cooled with UNICON.

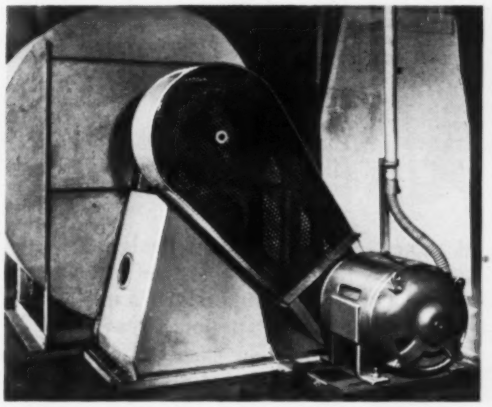
KRAMER **UNICON**

Stands, hoods, and wind deflectors
are available for simplified
outside mounting
You need nothing else!

WRITE FOR BULLETIN U-210C

KRAMER TRENTON CO. • Trenton 5, N.J.

This modern air conditioning system uses ELLIOTT C-W motors



A 40-hp, 1745-rpm squirrel-cage motor driving a distribution fan at the U.N.

United Nations Headquarters—New York City comprises three attractively designed buildings. The Secretariat Building, shining in metal and blue-green glass, rises majestically 38 stories above the water. The rambling, low-set Conference and General Assembly Buildings complete the setting. Day in and day out, approximately 3,500 employees are going about their tasks under pleasant, comfortable working conditions. A modern, efficient air conditioning system makes this possible. Contributing to the effectiveness of this system are over 100 Elliott C-W motors. Ranging in size to 40 hp, they are driving fans to distribute clean, comfortable air throughout the installation.

For details on Elliott C-W motors in air conditioning systems, call your Elliott Representative, or write Elliott Company, Crocker-Wheeler Division, Jeannette, Pa.

ELLIOTT Company

STEAM TURBINES • MOTORS • GENERATORS • DEAERATING HEATERS • EJECTORS • CONDENSERS
CENTRIFUGAL COMPRESSORS • TURBOCHARGERS • TUBE CLEANERS • STRAINERS

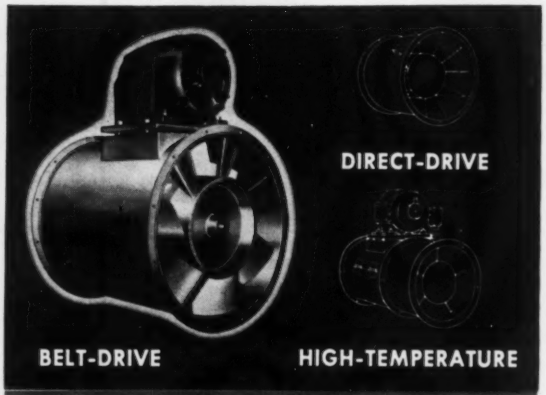
The United Nations—located at 1st Ave. and 42nd St., New York City.
Builder and General Contractor: Fuller-Turner-Walsh-Slattery, Inc.
Consulting Engineers: Syska & Hennessy, Inc.
Architects: Harrison & Abramovitz.
Mechanical Contractors: General Assembly Bldg.—Korby Saunders, Inc.
Secretariat Bldg.—Almirall & Co., Inc.

Photo courtesy of United Nations

Hartzell Vaneaxial Blowers

rugged...

Hartzell vaneaxial blowers are designed and built for long life and trouble-free service in the most punishing industrial applications. All welded construction. Heavy-gauge steel throughout. Spark-proof aluminum impeller. Thousands of successful installations have proved that they've got what it takes.

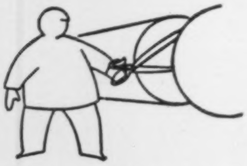


Hartzell Vaneaxial Blowers are available in 10 belt-drive sizes, 12" to 54", and 6 direct-drive sizes 18" to 42". With the new Hartzell High-Temperature Vaneaxial (same sizes, same performance as standard belt-drive models) you can move air at temperatures up to 350° or air containing acids or alkalies without fear of premature failure of belt and bearings.

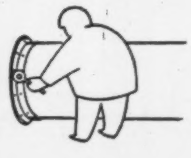
powerful...

The new 54" belt-drive model will deliver 85,800 CFM against $\frac{1}{2}$" static pressure (54.8 BHP) or 54,400 CFM against 7" static pressure (85.9 BHP). That's a powerful blast of air. Complete performance data on all models is included in Bulletin A-110. Mail the coupon below to get your free copy.

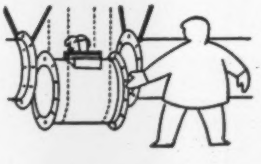
...and easy to install



Cut out a duct section same length as blower.



Bolt angle-iron flanges to duct ends.



Bolt blower to duct ends just installed, and brace duct flanges.

And that's all—just make electrical connections and you're done.

HARTZELL

propeller fan co.

Div. of Castle Hills Corp.

Please send me my free copy of Bulletin A-110, "Hartzell Vaneaxial Blowers."

Name ____________________
Company ____________________
Street & Number ____________________
City & State ____________________
If student, check here for special information ☐

Dept. V

PIQUA, OHIO

PROPELLER-TYPE FANS • BLOWERS
ROOF VENTILATORS • UNIT HEATERS

ENGINEERING OFFICES IN PRINCIPAL CITIES

A NEW LOW IN PUMPING HEAD!

NEW PRITCHARD LOLINE COOLING TOWER DISTRIBUTION SYSTEM ASSURES UNUSUALLY LOW PUMPING HEAD

The new Pritchard *LOLINE* tower distribution system assures an unusually low pumping head with greater economy in pump capacity and power consumption. This unique system is simple, non-clogging, easily cleaned. Splash box assemblies properly distribute incoming water into each distribution basin. Factory machine-drilled orifices in the floor distribute the water uniformly over wood filling at any flow of water within the limits of performance. There are no nozzles to clog or wear out.

As an exclusive optional feature, internal water supply piping terminating in a connection at the base of the tower is available, eliminating exterior water supply piping entirely!

Shown below is an external supply system which is also available as an optional feature.

INDUSTRY'S PARTNER FOR PROGRESS

COOLING TOWERS
AIR COOLED HEAT EXCHANGERS
GAS & AIR TREATING EQUIPMENT

REPRESENTATIVES IN PRINCIPAL CITIES FROM COAST TO COAST

J.F. Pritchard & Co.
OF CALIFORNIA
A DIVISION OF J. F. PRITCHARD & CO.
Dept. 450, 4625 Roanoke Parkway, Kansas City 12, Mo.

LOWEST SILHOUETTE TOWER OF 75 TONS CAPACITY AND UP NOW AVAILABLE!

The Pritchard *LOLINE* Tower is the lowest (7′ 7-11/16″ overall) tower of 75 tons capacity and up now available. The *LOLINE* incorporates many features in its new design which are unique in low silhouette tower construction:

1. Attractive exterior
2. Rugged construction
3. Special water piping arrangement
4. Easy to install and maintain
5. All steel parts galvanized

Pat. Pending

SEND FOR YOUR COMPLIMENTARY COPY OF THIS NEW TOWER BOOKLET!

New Pritchard *LOLINE* Cooling Tower bulletin describes the many unique design features in detail; contains: cross-sectional drawing, photographs of construction features, capacities, optional equipment. Send for your complimentary copy today!

Sign Up SPORLAN'S CHAMPIONSHIP TEAM
for
PEAK PERFORMANCE
throughout your entire
AIR CONDITIONING
SEASON

because
like any Top Team
SPORLAN
offers you
PEAK PERFORMANCE
at *Every* Position...
in the AIR CONDITIONING FIELD

Sporlan
JOE SERVICE

Position 1

The Catch-All is the perfect filter-drier, assuring you clean, dry, acid-free, sludge-free refrigerant!

Position 2

Nothing can touch the Peak Performance of Sporlan's Solenoid Valves. They're tight closing, their coils are layer wound and so well insulated, they defy electrical failure!

Position 3

No hunting here, thanks to Sporlan's Thermostatic Expansion Valves with Flow Master elements. You can be sure of Peak Performance without ever worrying again about alternately flooded and starved evaporators!

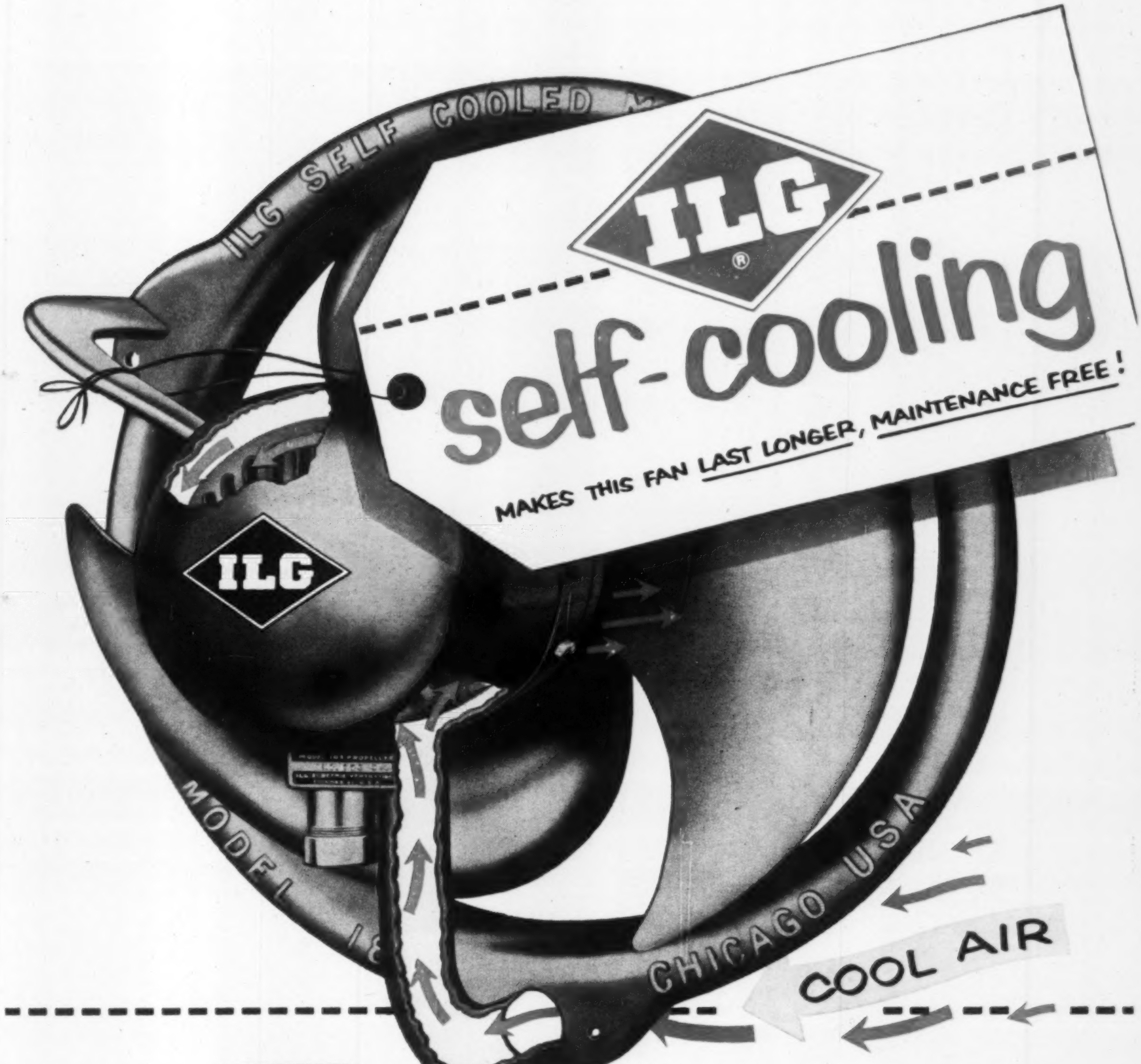
Position 4

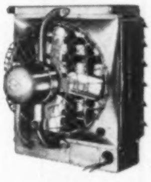
Sporlan Peak Performance Distributors have a perfectly designed nozzle and conical button to assure uniform distribution to all circuits.

So Remember, *when you're lining up your positions for a championship air conditioning team... Buy Sporlan Right-Down-The-Line and get Peak Performance throughout your entire air conditioning season.*

SPORLAN

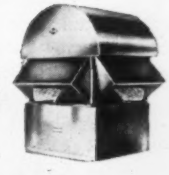
SPORLAN VALVE COMPANY
7525 SUSSEX AVENUE ST. LOUIS 17, MISSOURI
Export Department: 89 Broad Street, New York 4, New York





ILG Unit Heaters
The complete line—steam, hot water, gas or electric—with capacities ranging from 18,600 to 286,000 BTU.

ILG Centrifugal Fans
Designed for a wide variety of pressure and volume requirements — certified capacities ranging from 374 CFM to 116,400 CFM.



ILG Power Roof Ventilators
Long-lasting, quiet, easy to install, leak-proof—provide efficient ventilation independent of wind and weather.

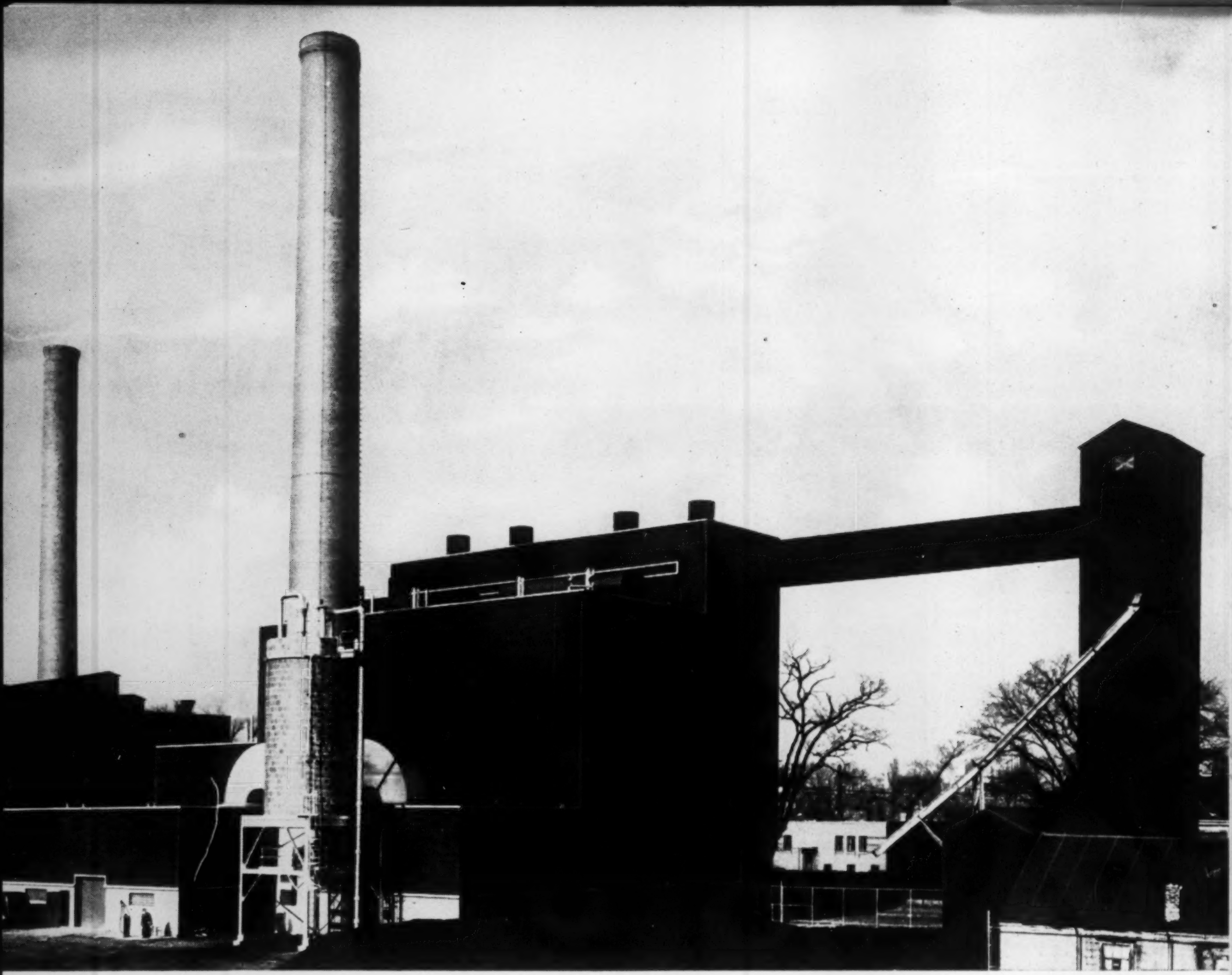
INSTALL ILG SELF-COOLED PROPELLER FANS

The secret of ILG's better design is the exclusive *self-cooled* motor! Clean, cool, fresh air is drawn into the motor enclosure through an *outside vent pipe*. The motor stays clean and cools itself – dusty, greasy air can never reach it to interrupt service or shorten its life! ILG self-cooled fans have the lowest operating and maintenance cost of any open type motor combined with a fully enclosed motor . . . a savings up to *10% on power costs alone!*

ILG
PROPELLER FANS

Get this Free Catalog now!
Here's the information you should have before planning your ventilation requirements. ILG's new Propeller Fan Catalog is your complete and authoritative guide to better ventilation. Write for your catalog No. 151 today.

ILG ELECTRIC VENTILATING CO.
2826 N. Pulaski Road, Chicago 41, Illinois



Syracuse U. burns coal the modern way for dependable steam supply

Over the past decade, there has been a growing demand on the steam plant at Syracuse University. Not only has the university itself expanded rapidly, but six hospitals on or adjacent to the campus depend on university facilities for steam. When the original steam plant proved inadequate (total output 190,000 lbs. per hr.), the university built a completely up-to-date unit to replace it.

The internal operation of this new plant is as modern as its panel and glass exterior. An automatic handling system delivers the coal from hopper to bunker to pulverizer to boiler. A pneumatic-type integral combustion control system operates the boilers automatically. A pneumatic disposal system removes fly ash and cinder ash automatically. Today Syracuse University is assured an adequate steam supply—capacity 300,000 lbs. per hr.—and a clean, economical operation in the process.

Investigate Your Fuel Costs

If you're planning to modernize your plant or build a new one—or if you are just interested in cutting fuel costs—find out how coal, burned the modern way, compares to other fuels. Why not talk to a consulting engineer or your nearest coal distributor? Their advice may save you thousands of dollars each year.

facts you should know about coal

Up-to-date coal burning equipment can give you 10% to 40% more steam per dollar.

Automatic coal and ash handling systems can result in a virtually labor-free plant.

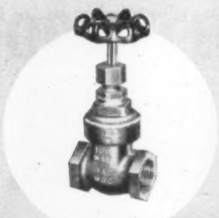
Coal is the safest fuel to store and use. No dust or smoke problems when coal is burned with modern equipment.

In most industrial areas, bituminous coal is the lowest-cost fuel available.

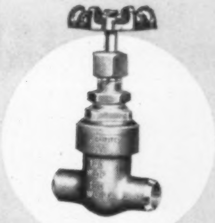
Between America's vast coal reserves and mechanized coal production methods, you can count on coal being plentiful and its price remaining stable.

For further information or additional case histories showing how other plants have saved money burning coal, write to the address below.

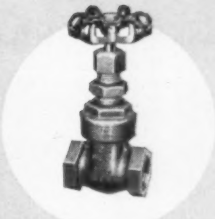
NATIONAL COAL ASSOCIATION
Southern Building, Washington 5, D.C.



NO. 2500 GATE
100 Lbs. W.S.P.
150 Lbs. W.O.G.
Flexitite Disc
Sizes — ¼ through 3 inches
Also available with drain, sizes—½" through 2"
(Fig. No. 2508)

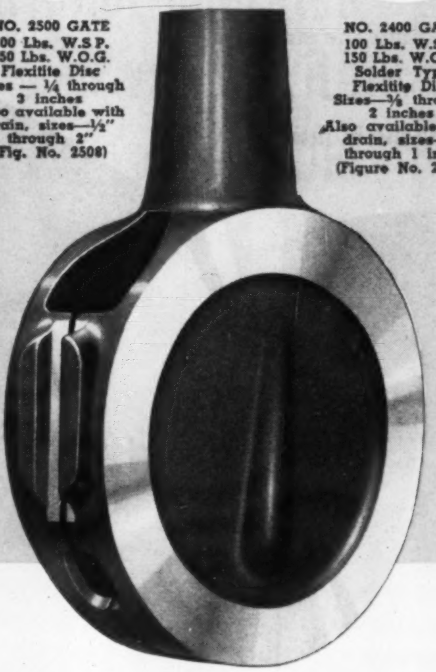


NO. 2400 GATE
100 Lbs. W.S.P.
150 Lbs. W.O.G.
Solder Type
Flexitite Disc
Sizes—⅜ through 2 inches
Also available with drain, sizes—⅜ through 1 inch
(Figure No. 2408)

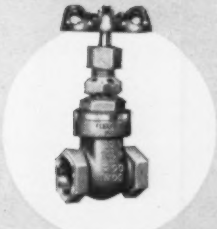


NO. 2000 GATE
125 Lbs. W.S.P.
200 Lbs. W.O.G.
Flexitite Disc
Sizes—⅛ through 3 inches

NO. 2800 GATE
125 Lbs. W.S.P.
200 Lbs. W.O.G.
Solder Type
Flexitite Disc
Sizes—⅜ through 3 inches



NO. 2100 GATE
Rising Stem
125 Lbs. W.S.P.
200 Lbs. W.O.G.
Flexitite Disc
Sizes—¼ through 3 inches



NO. 8500 GATE
125 Lbs. W.S.P.
200 Lbs. W.O.G.
Braze Type
Flexitite Disc
Ends Bored for Type-B Tubing
Sizes—½ through 3 inches

FLEXITITE means LEAKTIGHT

and every O-B Gate Valve has a Flexitite Disc®

The slot around the edge of the Flexitite Disc permits it to flex for adjustment to any slight misalignment in the valve seat. This flexing both reduces wear on disc and seat and works to assure a leaktight shutoff.

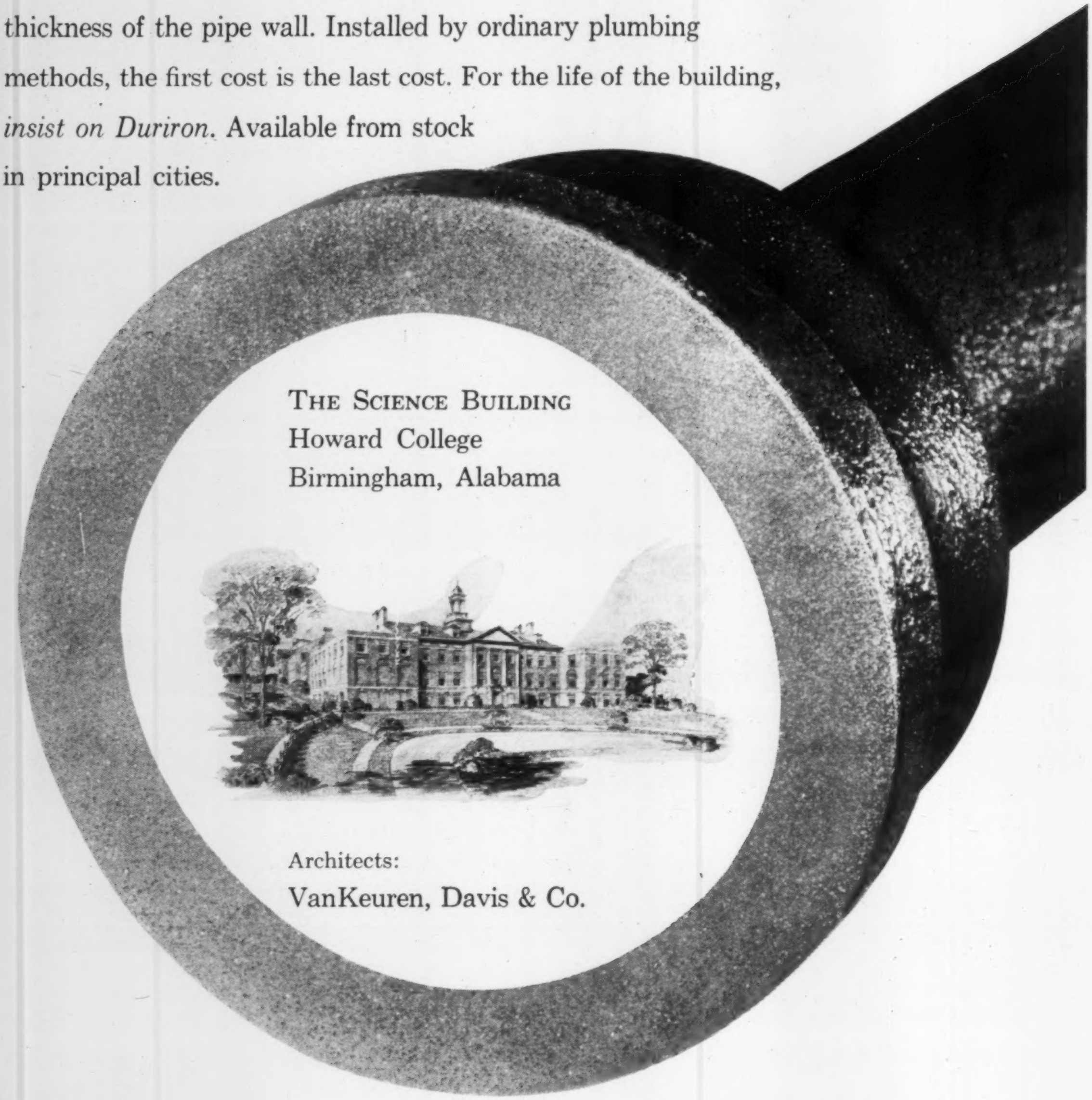
All O-B Gates feature the Flexitite Disc. Besides the 100 and 125-lb. (WSP) bronze valves shown here, O-B offers other gates at 150 and 200 pounds pressure. They are described fully in Bulletin 1323-V which is available on request. Or consult your O-B distributor who can tell you all about the Ohio Brass line of quality bronze valves, including gates, globes and checks and valves designed especially for air-conditioning installations.

Ohio Brass
MANSFIELD OHIO, U.S.A.

4570-V

Duriron® vs. Corrosion is **'NO CONTEST'** *at Howard!*

Duriron Acid Proof Drain Pipe will probably outlast the new Science Building at Howard College. At least, this has been the history of Duriron installations. The reason is that Duriron's extremely high resistance to corrosion is present through the entire thickness of the pipe wall. Installed by ordinary plumbing methods, the first cost is the last cost. For the life of the building, *insist on Duriron.* Available from stock in principal cities.



THE SCIENCE BUILDING
Howard College
Birmingham, Alabama

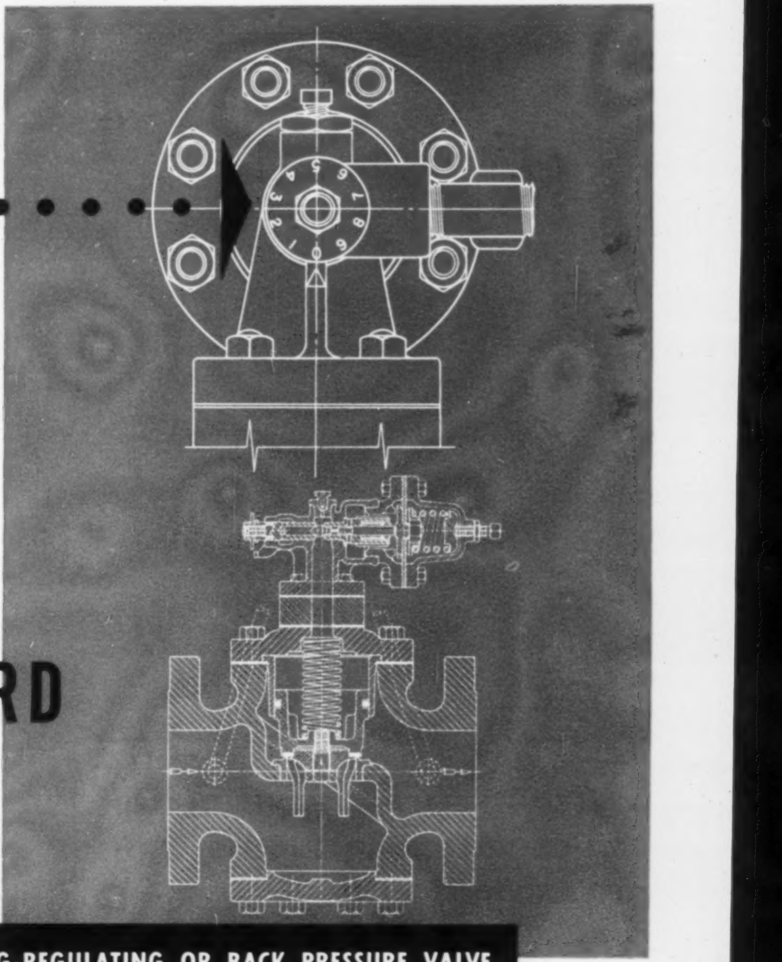
Architects:
VanKeuren, Davis & Co.

DURIRON
LOOK FOR THE NAME ON EVERY PIECE

The Duriron Company, Inc.
Dayton, Ohio

FOR EXCEPTIONAL CONTROL

a pilot-operated valve with adjustable throttling range



the NEW Improved

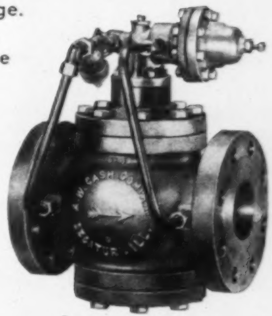
CASH STANDARD

TYPE 10 VALVE

- **SELF-CONTAINED**
- **SINGLE SEAT— tight closure**
- **LARGE CAPACITY**

SERVES AS PRESSURE REDUCING-REGULATING OR BACK PRESSURE VALVE

- Improved Y-type strainer in pilot control line protects pilot.
- Simple dial-type range selector permits selection of throttling range required for the most stable and sensitive control.
- Switching control piping easily converts valve from pressure reducing to back pressure operation.
- Diaphragm assembly easily changed to convert to different pressure range.
- Packless design results in low friction and high sensitivity.
- Recommended for: water systems, altitude control, as an unloading valve on extrusion presses, back pressure control, oil refineries.
- For use with water, gas, air, light oils, refrigerants (ammonia, freon).
- Materials: iron, bronze or steel body; bronze or stainless steel trim; monel trim on pilot valve. Composition or metal seat.
- Sizes: 2" to 3" with screwed ends.
  2" to 12" with flanged ends.

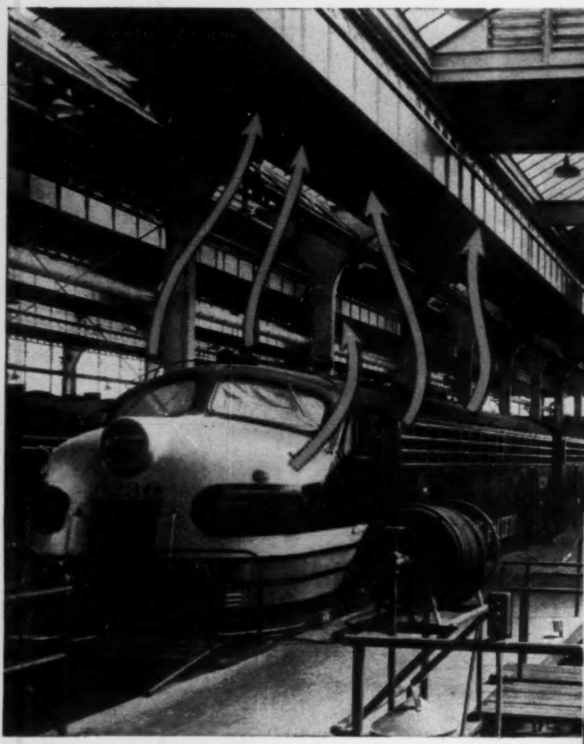


WRITE TODAY FOR COMPLETE INFORMATION AND LITERATURE

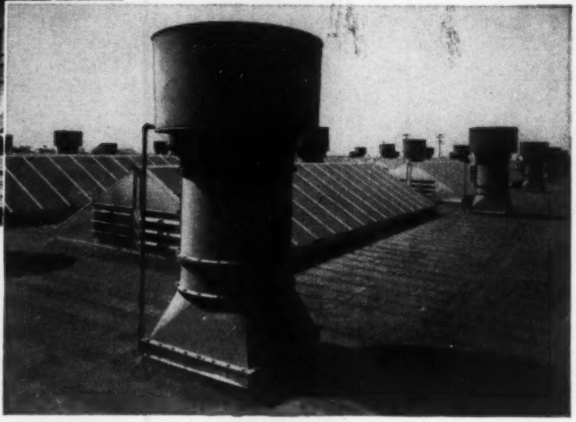
CASH CS STANDARD

A. W. CASH COMPANY • P.O. BOX 551, DECATUR, ILL.

PRESSURE, HYDRAULIC, TEMPERATURE, PROCESS AND COMBUSTION CONTROLS



DEODORIZING DIESELS



HOW SOUTHERN PACIFIC VENTILATED ITS ROSEVILLE ROUNDHOUSE WITH JOY AXIVANE® FANS

When in need of servicing, the diesel locomotives of Southern Pacific are driven into the roundhouse and parked under long ceiling hoods. As the engines are raced or idled, the customary fumes are emitted from the exhaust. BUT, you have to sniff hard to catch even a faint whiff of diesel fumes in the roundhouse!

HOW'S IT DONE? By Joy Axivane Fans, of course. Thirty-six fans are hidden in the ceiling hoods. The exhaust gases are hustled out—at the rate of 726,000 CFM—before they can contaminate the surrounding air.

TOPS IN EFFICIENCY. Six 1½ HP models handle 11,000 CFM each, while thirty 5 HP models handle 22,000 CFM each. The fans are actually located right in the exhaust ducts—not an inch of valuable room space is sacrificed!

HIGH-TEMPERATURE PROBLEM, TOO. The air being exhausted sometimes reaches a temperature of 280° F., but temperature variations have little effect on these fans. The vaneaxial design, with adjustable blades, packs plenty of punch—under all conditions. The in-line construction and in-the-duct installation . . . possible only with this type of fan . . . make for real space savings.

136 MODELS. The Joy Axivane Fan line is a wide one. Capacities range up to 200,000 CFM and pressures top 11″ wg. Some models will nestle in the palm of your hand while others would dwarf your home. Want the whole story? Write for our Bulletin J-611, TODAY. **Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.,** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

Consult a Joy Engineer, or

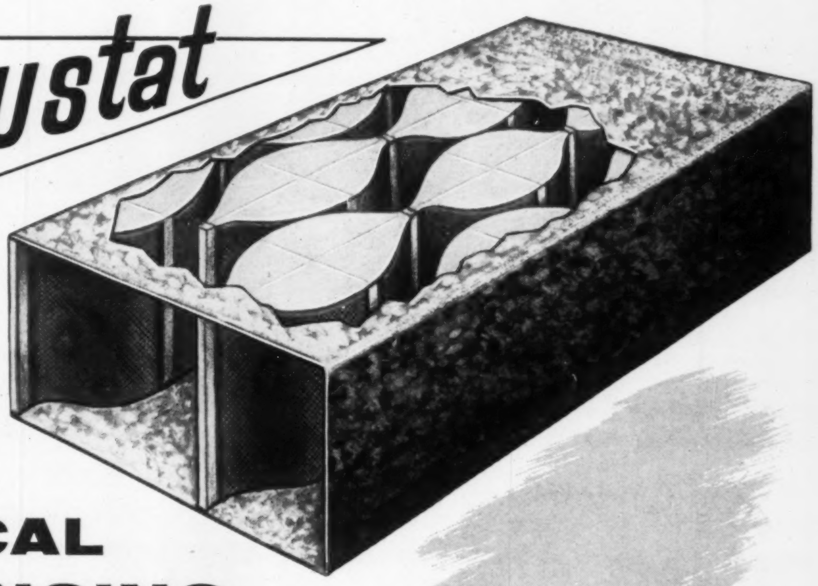
WRITE FOR THIS BOOKLET #J-611

W&D 1-4873

JOY

SPECIALISTS IN THE COMPRESSION AND MOVEMENT OF AIR AND GASES SINCE 1885

Aircoustat



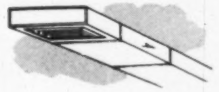
PRACTICAL SILENCING

for AIR CONDITIONING SYSTEMS

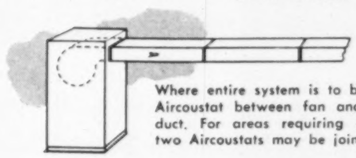
Aircoustat is a compact, *completely packaged* unit for silencing fan and air noise in air conditioning systems. Easily installed directly into the duct work, Aircoustat eliminates the need for costly, extensive duct lining. And results are astonishing: one 7 *foot* unit reduces noise level below what *100 feet* of commercial duct lining could accomplish.

Engineered to provide broad band attenuation with low pressure drop, Aircoustat is available in 14 standard sizes for use with all styles and sizes of duct, and 8 types to meet any desired conditions. Selection is no problem: ***if it fits geometrically, it fits acoustically.***

Where to install Aircoustat

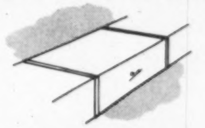


Aircoustats are incorporated as part of the duct work. If only selected areas require quiet, install above individual diffusers.

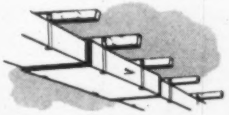


Where entire system is to be silenced, insert Aircoustat between fan and first length of duct. For areas requiring special silencing, two Aircoustats may be joined in series.

How to install Aircoustat



Aircoustat requires no special tools for installing. It is constructed to be joined to ductwork with a lock seam.



If ductwork and Aircoustat differ in size, a canvas or asbestos coupling may be used. If ductwork is hung, support Aircoustat similarly.

Mail this coupon TODAY ▶▶▶

SILENCE SERVICE

Industrial Sound Control Inc.

45 Granby Street, Hartford 12, Conn.

INDUSTRIAL SOUND CONTROL, INC.
45 Granby St., Hartford 12, Conn.
Please send me more information on AIRCOUSTAT.

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TITLE ....
COMPANY ....
ADDRESS ....
CITY .... ZONE .... STATE ....

Design fundamentals of the

ALL-AIR HIGH VELOCITY distribution system

By F. J. KURTH | *Vice President of Engineering*

Anemostat Corporation of America

A national survey reveals that today, more than ever, engineers are studying, learning and using high velocity-high temperature differential air distribution. Here is a brief discussion of the advantages of the all-air high velocity system over conventional and mixed cycle (air and water) systems.

1. No Coils — No Clogging — No Odor—There are no coils in the all-air high velocity units. Damp coils collect lint and emit dank odors, and the coils must be cleaned periodically.

2. No Individual Fans — Filters — or Electric Motors — The all-air units operate entirely with air which is processed in the main equipment rooms. The 100% induction units utilize the kinetic energy of the high velocity air to mix primary air with the room air.

3. No Conflict of Trades—The all-air units are installed by the sheet metal trades only.

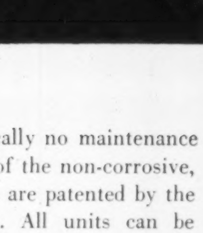
4. More Effective Use of Outside Air in Spring and Fall—More primary air is delivered to the all-air units than to induction coil units. This allows the engineers to operate in the Spring and Fall on outside air and thereby save refrigeration.

All-air high velocity units offer scientific air diffusion. Each high velocity unit is provided with an aspirating or high induction type air diffuser which is scientifically designed to diffuse air without drafts. Each unit can be pressure balanced by an easy-to-operate balancing device and a calibrated orifice. In fact, the Anemostat all-air high velocity system can be balanced more accurately than other systems and in less than half the time required to balance a low velocity system.

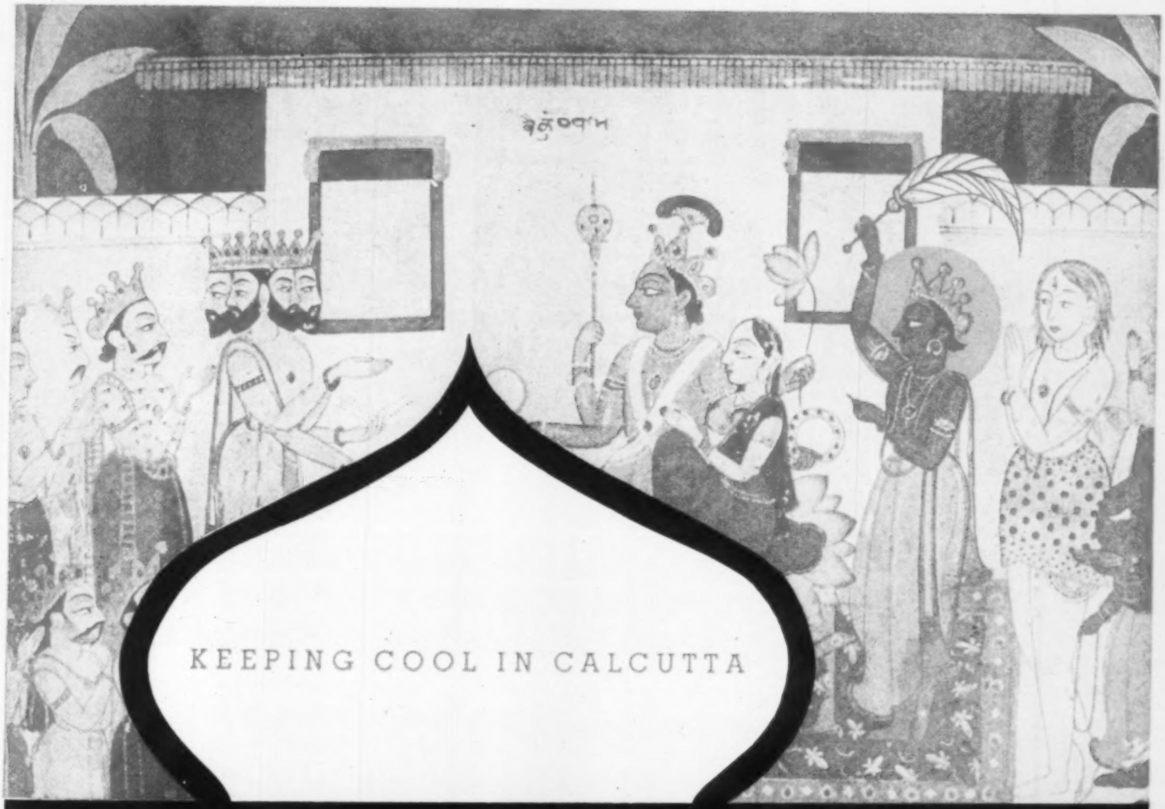
High velocity units require practically no maintenance after installation. They have valves of the non-corrosive, die-cast, "rocket-socket" type, which are patented by the Anemostat Corporation of America. All units can be adapted for the following variations:

1. Single duct for zone control or individual thermostatic or manual remote control.
2. Dual duct for thermostatic control or any other type of control.
3. Single or dual duct units with the diffuser fastened to the unit, or remote from the attenuating unit.
4. Under-the-window, sidewall or ceiling type installations.
5. Can be provided with standard aspirating diffusers or 100% induction type diffusers.
6. Induction type units handle temperature differentials up to 33° below ambient.

Selection Manual Contains Data on High Velocity Units

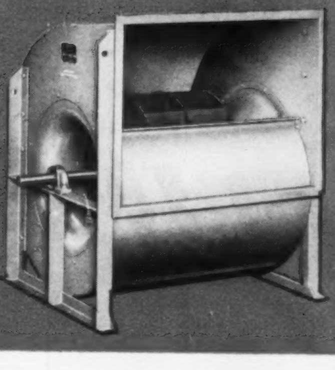


New Selection Manual 50 gives extensive selection and application data on high velocity all-air distribution systems. Write on your business letterhead for Selection Manual 50 to the Anemostat Corporation of America, 10 E. 39 Street, New York 16, New York.



KEEPING COOL IN CALCUTTA

Keeping the famous Society Theatre in steaming Calcutta comfortably cool is a man-sized role. Utility Blowers were chosen for that role. Relaxed audiences applaud the choice, while Utility Blowers answer encore after encore throughout the world.



UTILITY

Manufacturers of heavy and standard duty blowers for heating, air conditioning and ventilating installations. Producers of blowers and blower parts for original equipment manufacturers. Write for catalogue data.

UTILITY FAN CORP.

911 East 59th Street
Los Angeles 1, California

A DIVISION OF UTILITY APPLIANCE CORP.

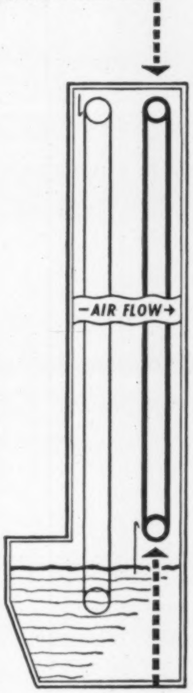
GET

Double Protection!

ONLY **STAYNEW**

AUTOMATIC AIR FILTERS HAVE THIS DRY CURTAIN........

Staynew Model A-3 Automatic is the only air filter designed to give the *double protection* of double filter curtains—the first wet, the second dry. There's never oil entrainment and the cleaned side of curtains is always on the filtered air side. Staynew Model A-3 Filters are designed for both light dust load installations and for heavy duty industrial service where large volumes of air are to be filtered.



Automatic Self
Cleaning Type Filter

- Highest efficiency of any mechanical type automatic filter.
- Exceptionally large dust holding capacity.
- Absolutely no oil entrainment in air stream.
- Motor and control unit mounted on clean side of filter.
- Combination gear and roller chain drive (no belts to slip).

Bring your filtration problems to Staynew. If the filtration of large volumes of dirty air at high efficiency and low cost is required, let the Dollinger engineers show you how and why Staynews are your answer. Write for descriptive folder.

Representatives in Principal Cities

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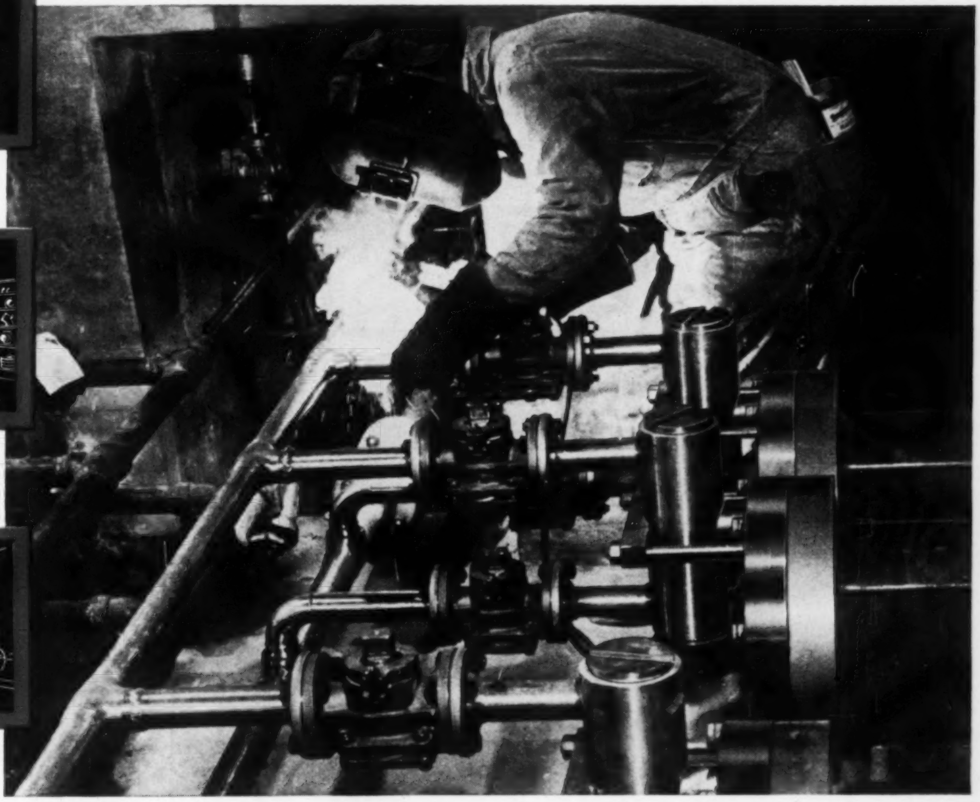
STAYNEW FILTERS

DOLLINGER
CORPORATION
9 Centre Pk., Rochester 3, N. Y.

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

WHY IT PAYS
TO DO BUSINESS
WITH THE
LEADER



Tube Turns' nearby complete stock SAVES YOUR PURCHASING TIME

Tube Turns' pioneering research GIVES YOU ADVANCED PRODUCTS

Tube Turns' engineering help GIVES YOU COST-CUTTING IDEAS

In stainless steel or any other metal...

Your nearby TUBE TURNS' Distributor gives you *more for your money!*

You have a selection from the world's most complete line of welding fittings and flanges when you specify "TUBE-TURN"*. This leading line includes *stainless steel* fittings and flanges such as used in the acid-pumping station shown above . . . also alloys, non-ferrous metals and carbon steels . . . more than 4000 items to match *your* needs. To save purchasing time, put all your requirements on *one order* and call your *nearby* Tube Turns' Distributor for quick delivery and good service!

*"TUBE-TURN" and "tt"
Reg. U.S. Pat. Off.

TUBE TURNS LOUISVILLE 1, KENTUCKY

tt TUBE-TURN

A Division of National Cylinder Gas Company

DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Cleveland • Detroit • Chicago • Kansas City • Denver
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POWELL VALVES . . . THE COMPLETE QUALITY LINE . . . POWELL VALVES

. . . THE COMPLETE QUALITY LINE . . . POWELL VALVES . . . THE COMPLETE QUALITY LINE . . .

. . . THE COMPLETE QUALITY LINE . . . POWELL VALVES . . . THE COMPLETE QUALITY LINE . . .

POWELL VALVES THE COMPLETE QUALITY LINE

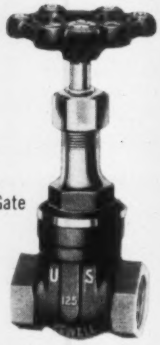


FIG. 500—Bronze "U.S." Screwed Gate Valve For 125 W.S.P.

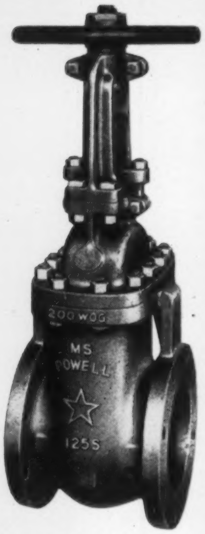


FIG. 1793—Iron Body Bronze Mounted Gate Valve For 125 Pounds W.P.

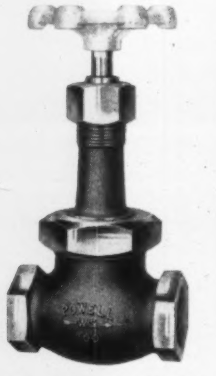


FIG. 2608—Bronze "W.S." Full Flow Globe Valve For 200 Pounds W.P.

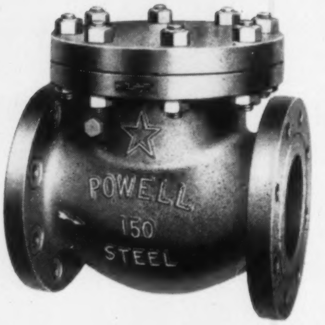


FIG. 1561—150 Pound Steel Swing Check Valve

POWELL VALVES . . . THE COMPLETE QUALITY LINE . . . POWELL VALVES

When you think of valves—think of Powell. For Powell can supply exactly the size and type of valves you need. And you can be certain that every Powell Valve will give you dependable flow control.

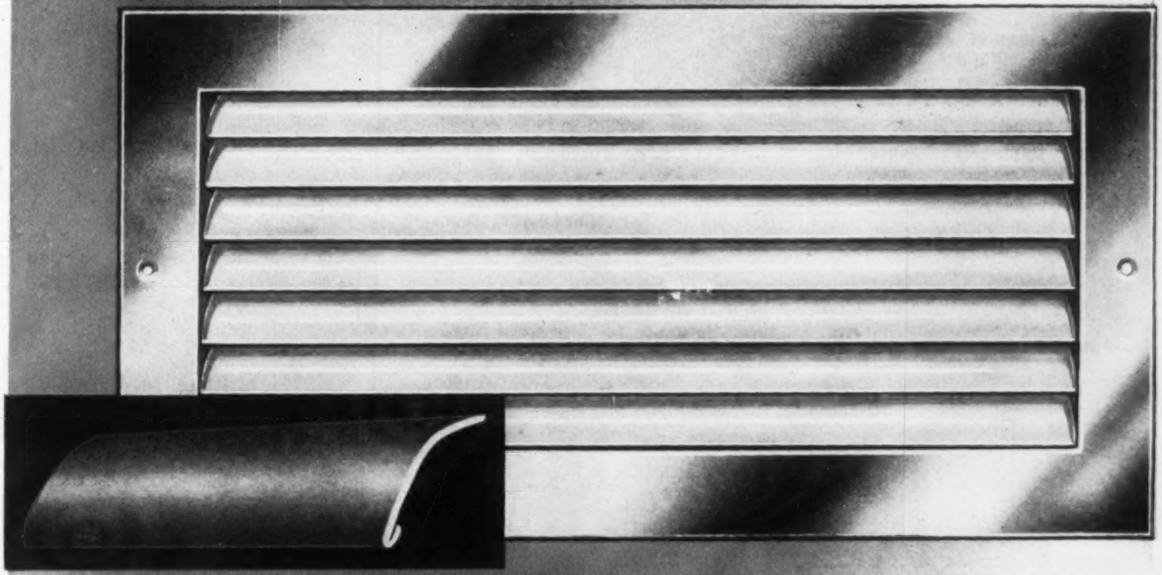
Shown above are just a few Powell Valves. Investigate these . . . *and* the *complete* line of quality valves that have a proven record of long and dependable service.

Consult your Powell Valve distributor. If none is near you, we'll be pleased to tell you about our complete line, and help solve any flow control problem you may have. Write . . .

The Wm. Powell Company,
Cincinnati 22, Ohio . . . . . **109th year**

NEW IMPROVED

Return Air Grille



CURVED HEMMED FINS GIVE 80% FREE AREA

designed by TITUS

Large free area means the Titus Return Air Grilles HANDLE MORE AIR PER SQUARE INCH. Makes it possible for a smaller grille to give superior performance . . . at lowest cost . . . and correct performance faults of other parts of an air conditioning or heating system . . . at the same time.

NEW BEAUTY

Matches design of supply grilles. Curved outline of fins add beauty . . . at the same time make it easy for maintenance personnel to keep grilles clean.

ONE-PIECE ASSEMBLY . . . FOR ANY SIZE OPENING

This eliminates expensive labor of handling old-fashioned grilles that are made in sections. Cuts costs of fitting, butting and screwing together these sections. Brings labor and grille costs to a minimum.

MORE STRENGTH PER SQUARE INCH

The curved hemmed fin design adds rigidity and durability to resist lower wall abuse. There is no see-thru due to the special positioning of the fins.

WRITE FOR FREE CATALOG TODAY

Return Air Grille
TITUS

TITUS MANUFACTURING CORP.
WAERLOO, IOWA

Gentlemen: I wish to improve the heating and air conditioning performance of my forced air systems . . . at the same time lower my grille costs. Please send me the new illustrated brochure on Titus Return Air Grilles.

Name

Company

Address

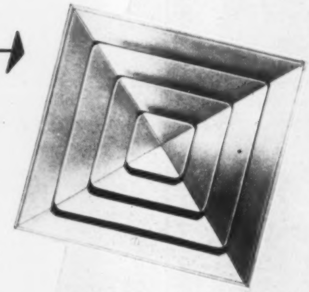
City State

air patterns unlimited without blank-offs

AGITAIR® *Custom Made*

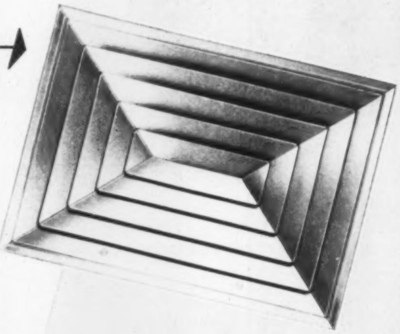
AIR DIFFUSERS with DIFFUSING VANES

. . . better because



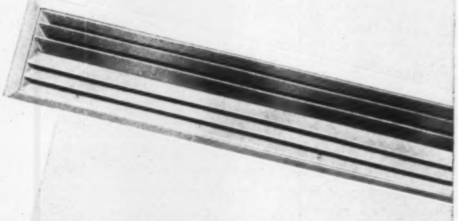
A good piece of equipment is no better than the experience behind it.

. . . better because



It's the original square and rectangular outlet . . . not just a poor imitation without distinctive features.

. . . better because



The company behind these diffusers has a history for doing things right and guaranteeing results.

you can depend on AGITAIR for better air

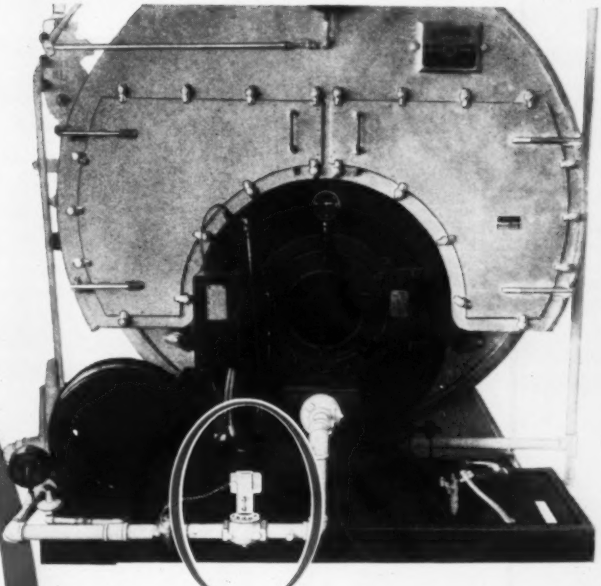
Your local AGITAIR representative will gladly assist you in selecting the proper size and air pattern to meet the requirements of your job. In addition, the engineering staff and laboratory resources of Air Devices Inc., are available to you.

AIR DEVICES INC.

185 MADISON AVENUE NEW YORK 16, N. Y.

Air Diffusers • Filters • Exhausters

Factory Mutual and Underwriters Laboratory Approved. Fast-Closing... Fast or Slow Opening to fit any combustion requirements. Optional Accessories for Special Needs.



GENERAL
CONTROLS

General Controls' new H-series Hydramotor gas fuel valves

FAST-CLOSING GAS VALVE
opens the way to Better Boiler Control

General Controls
NEW
H-Series
HYDRAMOTOR
Gas Fuel Valves

This new successor to General Controls' famous G-2 Hydramotor valve does even a better job... closing in one second or less in no-lag response to sensitive limit control commands (or power failure). Positive spring action guarantees this—with General Controls' single seat design to assure *really* tight shutoff, and electro-hydraulic action for ample opening power. All parts inside the cast iron body are aluminum or stainless steel, good for any gas. Overported body provides maximum capacity at minimum cost. Make it a policy to insure premium performance on every boiler job with General Controls' new H-series Hydramotors. Write for catalog with full details today.

GENERAL CONTROLS

MANUFACTURERS OF AUTOMATIC CONTROLS FOR HOME, INDUSTRY AND THE MILITARY

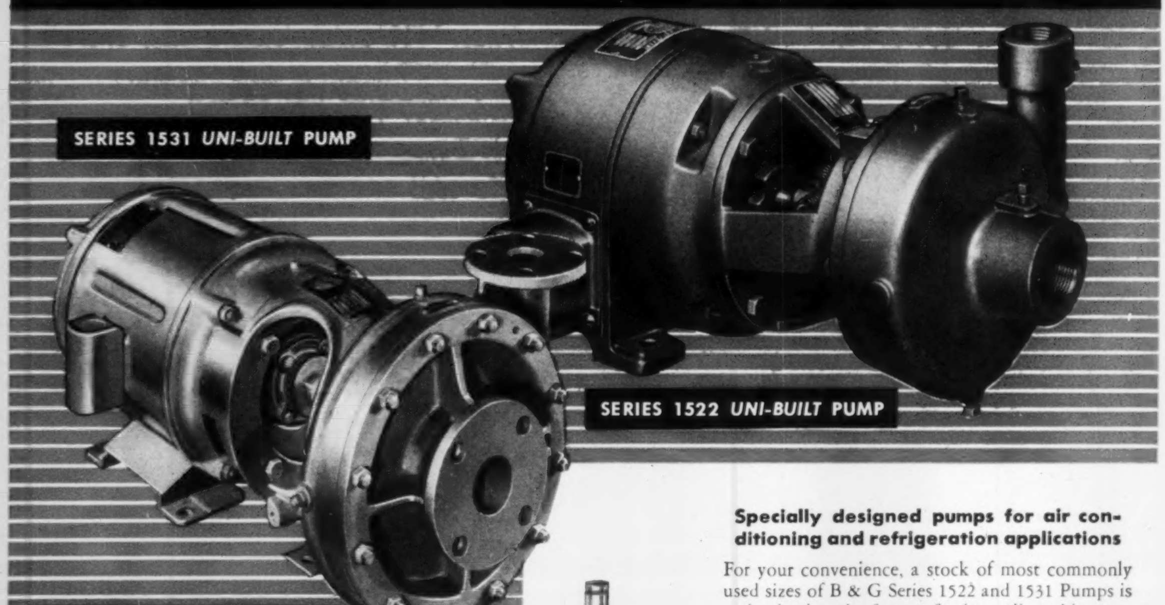
GENERAL CONTROLS • PERFEX CONTROLS

40 FACTORY BRANCH OFFICES SERVING THE UNITED STATES AND CANADA

FIVE PLANTS: IRON MOUNTAIN, MICHIGAN • GLENDALE, CALIFORNIA • BURBANK, CALIFORNIA SKOKIE, ILLINOIS • GUELPH, CANADA

NO WAITING FOR PUMPS AND CONDENSERS...

Popular sizes carried in stock!



Specially designed pumps for air conditioning and refrigeration applications

For your convenience, a stock of most commonly used sizes of B & G Series 1522 and 1531 Pumps is maintained at the factory for immediate shipment.

The leak-proof "Remite" Mechanical Seal alone makes these pumps a *buy!* This new-type Seal is harder than glass—wear-proof, corrosion-resistant. It's self-lubricating and eliminates leakage through the packing gland—assures trouble-free operation.

Smooth running . . . quiet!

Oversize bearings hold the shaft in alignment for smooth, quiet performance . . . balancing of the impeller prevents shaft vibration and seal failure. B & G Series 1522 and 1531 Pumps kept in stock at the factory are bronze-fitted only, but are available as all-iron, all-bronze or stainless steel units.

With all these advantages, prices are competitive.

B & G Condensers for replacement or original equipment in smaller installations

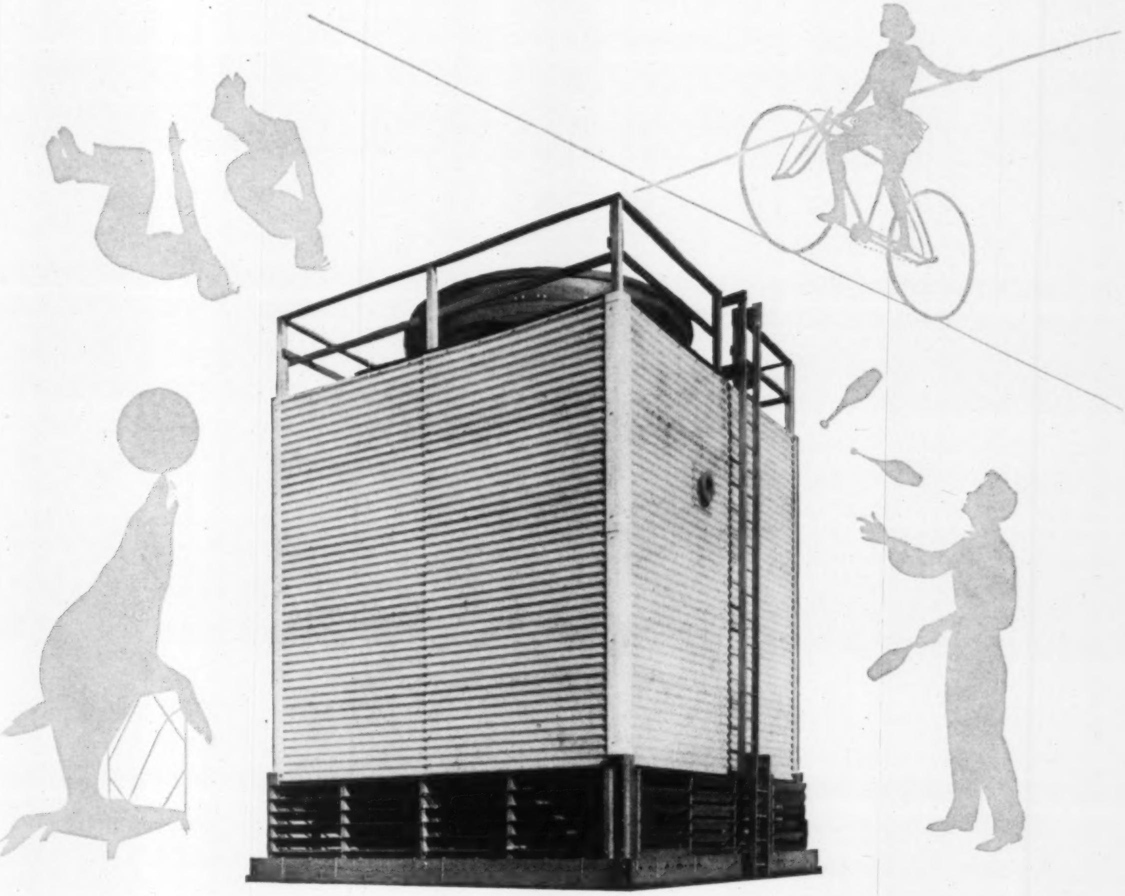
B & G quality in two moderately priced refrigeration condensers . . . built in popular sizes and stocked for immediate shipment.

Model CFG is a shell and coil condenser with extended surface for rapid transfer of heat. Correct designing and sturdy construction assure efficient, dependable service. Built to ASME Code requirements and labeled "UM".

Model CRF is an extended surface, straight tube unit with removable head for easy cleaning. It is constructed and stamped in accordance with ASME Unfired Pressure Vessel Code.

Send for complete information on B & G Stock Pumps and Condensers

BELL & GOSSETT
COMPANY
Dept. RDY-5, Morton Grove, Illinois
Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto, Canada



Balance, too, is important in

COOLING TOWERS

In the new CW SERIES COOLING TOWERS Marley engineers have achieved a high performance level that takes these counter-flow towers out of the "conventional" class. A carefully balanced expansion of major design elements results in more cooling ability for every frame size. These asbestos cement board cased redwood towers have:

GREATER FILL VOLUME — with more wetted surface in each cubic foot.

GREATER SPRAY BREAK-UP — high pressure down spray on closer centers.

Tradition has been discarded in the design of CW towers. The new closely packed filling affords an area of wetted surface that is new in concept, yet is positioned for minimum pressure drop. The increased surface cooling permits high pressure, close-center spray distribution for best primary break-up and cooling. Of course, these increases require more air and it's provided by more generous louvered openings, by high fan efficiency. There is no "too much" or "too little" in the CW design; balance is the keynote—balance that means more cold water . . . at record low cost. Steel cased and all-steel models are available.

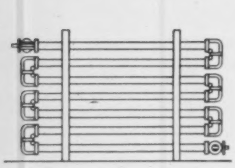
MARLEY

The Marley Company

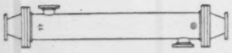
Kansas City, Missouri

Another reason why,
EBKO *is best for complete piping service . . .*

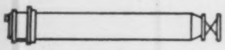
EBKO piping systems can save you thousands of dollars



Stack Heat Exchangers



Line Type Heat Exchangers



Suction Heaters

- EBKO custom designed piping systems are the absolute highest of quality, made with the finest of materials, sold at competitive prices. The keynote of EBKO design is simplicity. Here are some reasons why EBKO should be your first and last choice:

INSTALLATION EASE. EBKO pipe is built stronger than any other prefabricated pipe. Long lengths can be assembled on the ground and raised or at the side of the trench, then lowered. No special handling methods or tools and no special structural supports are needed.

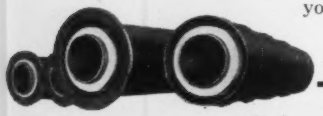
DURABILITY. Never has an EBKO prefabricated piping system failed. EBKO piping joints, both *interior* and *exterior,* can be tested and visually checked after each is assembled. Before you backfill the trench you know the job is sound.

ENGINEERING SERVICE. EBKO engineers will give job-site service prior to and during installation. These are highly trained, experienced men in all phases of piping.

DELIVERY. The simplicity of EBKO design means complete systems can be assembled and shipped in the very minimum of time.

NATIONWIDE SERVICE AND SALES. Factory representatives in every major city are located throughout the United States to answer any question that may arise.

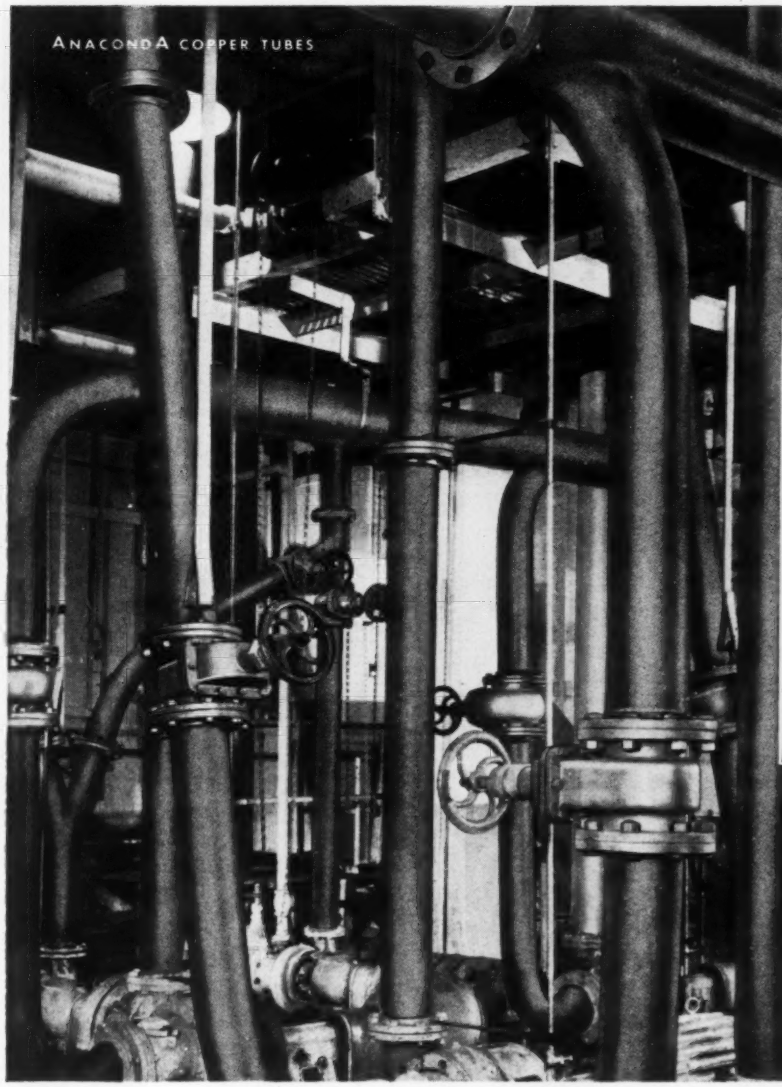
. . . there are many, many more reasons why EBKO should be your first and last choice. Call your local EBKO Representative and let him show you how to cut your piping system costs. Write for details—no obligation.



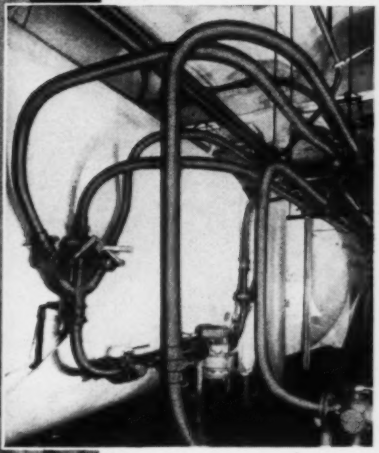
EBKO
Complete Prefabricated Piping Systems

E. B. KAISER CO.
Since 1890
2118 West Lake Avenue • Glenview, Illinois
Phone: Glenview 4-4500

FOR STEAM • HIGH TEMPERATURE WATER • CHILLED WATER • VISCOUS LIQUIDS



PUMPING ROOM of Liebmann Breweries, Inc., Brooklyn, N. Y. Notice the smooth bends and braze into main line (at top of picture). These are the kinds of savings you get with ANACONDA Copper Tubes.



FINISHED BEER is fed through 2-in. ANACONDA Copper Tubes to bottling room.

VERSATILE COPPER:

Efficient, economical piping for brewers of Rheingold Beer

In the pictures above you'll find numerous reasons why ANACONDA *Copper Tube* pipelines are *economy* pipelines. They adapt easily to any plant layout and equipment. Long lengths of lightweight ANACONDA Copper Tubes speed assembly, too. They may be bent so you can clear beams, girders and other obstructions—without extra joints and fittings. And fewer fittings mean less flow resistance, lower pumping costs. ANACONDA Copper Tubes with solder-type fittings also permit you to make sound, economical connections. You can also dismantle and reassemble *copper* tube lines easily to meet changing plant conditions.

ANACONDA Copper Tubes are strong, rustproof and corrosion-resistant. They remain smooth and clean inside.

For reliable service on ANACONDA Copper and Copper Alloys—consult your Anaconda Distributor.

Write for free booklet, "ANACONDA Copper Tubes for Industrial Applications" to *The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.*

5332 (Rev.)

ANACONDA®

Makers of copper tubes for industrial processing, water, heating, soil, waste and vent lines; welding rods; flexible metal hose and tubing; heat exchanger tubes; bus conductors; sheet copper; refrigeration products.

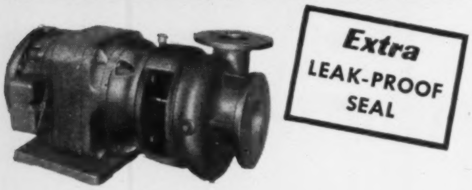
these "Extras" in CHICAGO PUMPS mean Longer, Better Performance Lower Cost Operation and Installation

Extra
POSITIVE
CLOG-PROOF
SEWAGE
HANDLING

FLUSH-KLEEN Sewage Ejector TYPE "S"

The Flush-Kleen Sewage Ejector can't clog because only liquid is handled by the impeller. Coarse matter is strained out, then backwashed from the strainer into discharge pipes. No strainer baskets to clean, no repairs due to clogging, no foul basins because solids never reach the wet basin. Besides being easier to maintain, Flush-Kleens last longer and require less power. Write for details in Bulletin 122C.

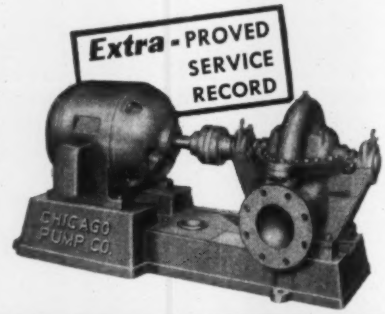
A COMPLETE LINE FOR EVERY BUILDING SERVICE



NEW F-C AND C-C PUMPS EITHER FLEXIBLE-COUPLED OR CLOSE-COUPLED

Compact, smooth running, quiet, — ceramic faced seal is highly resistant to wear — for circulating and booster service. Heads from 10 to 190 feet, capacities from 5 to 400 gpm. Bulletins 107 and 108.

For additional information on any of the above pumps, specify by bulletin number.



DOUBLE SUCTION HORIZONTALLY SPLIT CASE PUMP

Accurately machined and fitted revolving parts in carefully cast casing. Have proved reliable for house pump, circulating and booster service. See Bulletin 101.

Extra - LOW
INSTALLATION
COST
CHICAGO PUMP CO.

TYPE AVC CONDENSATION PUMP AND RECEIVER

Low inlet — no elaborate foundation needed for installation — for systems to 10,000 EDR and 10-30 psi. See Bulletin 245.

Extra - WON'T
STEAM-BIND

SURE-RETURN CONDENSATION PUMP AND RECEIVER

Low inlet — positive head on suction — no friction in manifold between pump and receiver — handles extremely hot condensate without steam binding — for systems to 75,000 EDR and low or medium pressures. See Bulletin 250.

Write to Department B

CHICAGO PUMP COMPANY

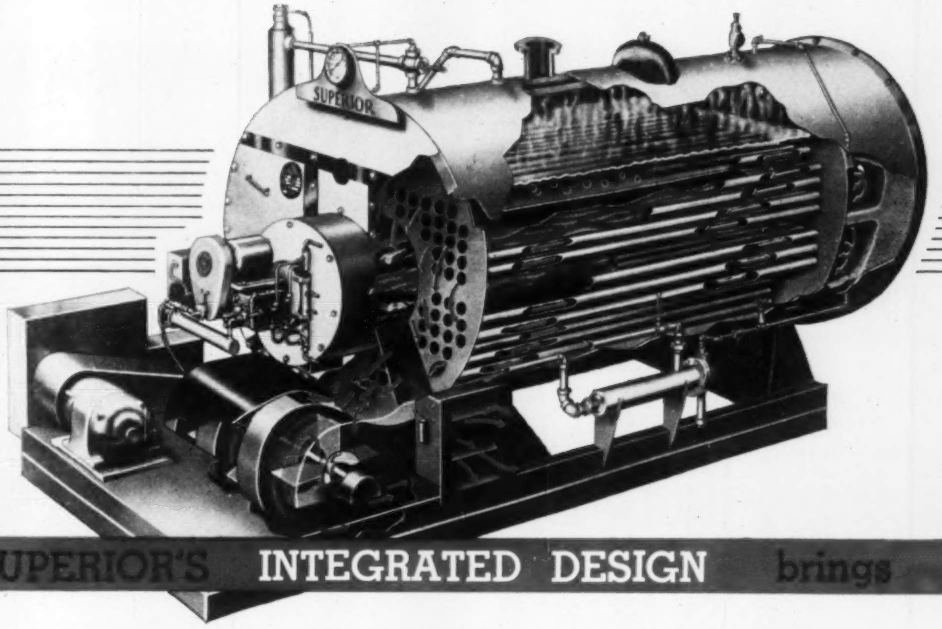
Subsidiary of Food Machinery and Chemical Corporation

BUILDING PUMP DIVISION

622 DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

Condo-Vac ®, Sure Return ®, AVC, LVC, Fire, House & Circulating Pumps, Pneumatic & Tankless Water Systems . . . Flush Kleen ® Sewage Ejectors, Little Giant ® & Non-Clog Bilge Pumps, Pumps for every Industrial use.

MAXIMUM HEAT TRANSFER STEAM RELEASE LIFE



SUPERIOR'S INTEGRATED DESIGN brings

the THREE KEYS to LOW COST STEAM

Superior Steam Generators burn oil or gas or both; are available in 18 sizes from 20 to 600 b.h.p. and pressures to 250 p.s.i. or for hot water. Write today for complete details in Catalog 704.

Integrated design is one of the most important advantages of completely packaged Superior Steam Generators. Components of these units are designed and built to operate efficiently with one another. This careful sizing and matching of burner capacity, heating surface, steam space and evaporating surface, eliminates the danger of waste due to excessive stack temperatures, or wet steam which results from surging and foaming in restricted space on the water side.

Bigger, heavier, more thoroughly engineered Superior Steam Generators provide the most steam per dollar over a longer serviceable life.

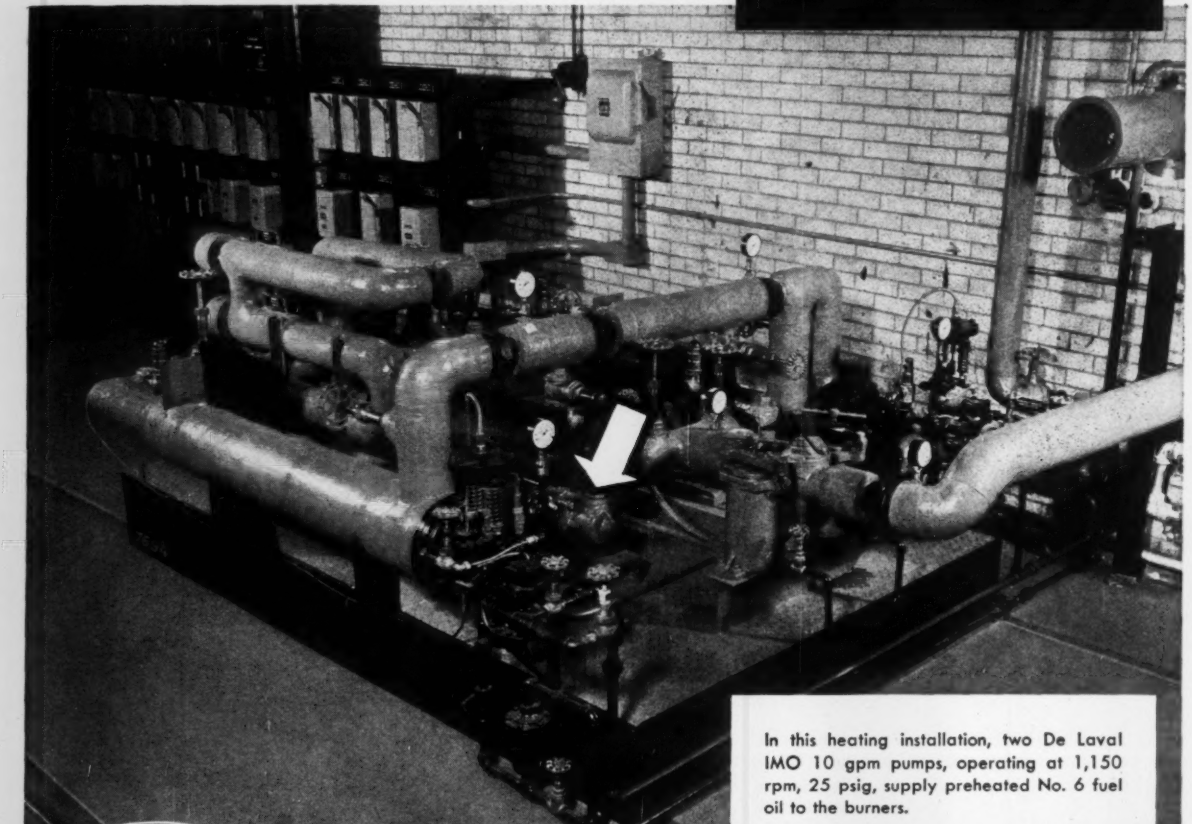
for performance you can **BANK** *on*

SUPERIOR
STEAM GENERATORS

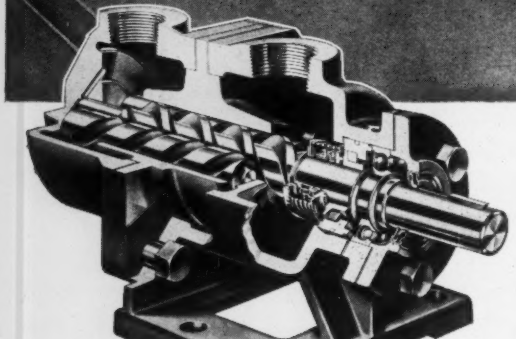
SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

Contracts are more profitable
when you install ***dependable***

DE LAVAL
IMO PUMPS



In this heating installation, two De Laval IMO 10 gpm pumps, operating at 1,150 rpm, 25 psig, supply preheated No. 6 fuel oil to the burners.



To increase your present—and future—profits on commercial heating jobs, install *dependable* De Laval IMO pumps on pump and heater sets. Their simple, trouble-free design saves you money on service calls . . . builds customer goodwill, for there's nothing to get out of order or need adjustment. No pilot gears, no sliding vanes, no reciprocating pistons. De Laval IMO's have only three moving parts—smoothly intermeshing rotors that propel the fluid axially in a steady flow without churning, pocketing or pulsation.

A wide range of De Laval IMO models specifically built for fuel oil service is available. Capacities up to 80 gpm, pressures to 275 psig. Write today for Bulletin LG-A.

DE LAVAL *IMO Pumps*

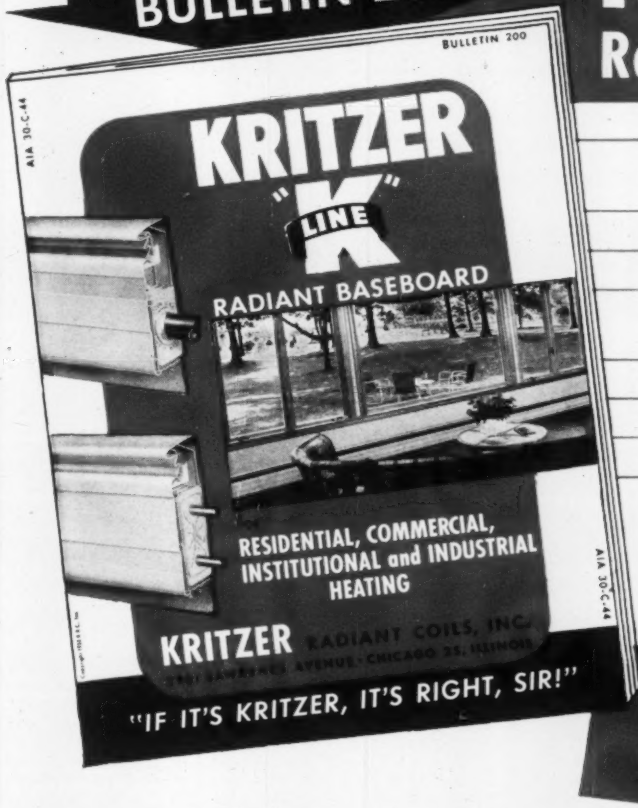
DE LAVAL STEAM TURBINE COMPANY
871 *Nottingham Way, Trenton 2, New Jersey*

DL272

Heating men
WRITE FOR THIS
FACT-FILLED
BULLETIN 200

It tells everything
you want to know about

KRITZER "K" LINE
Radiant Baseboard



BULLETIN 200

AIA 30-C-44

KRITZER
"K" LINE
RADIANT BASEBOARD

RESIDENTIAL, COMMERCIAL,
INSTITUTIONAL and INDUSTRIAL
HEATING

KRITZER RADIANT COILS, INC.
2901 LAWRENCE AVENUE · CHICAGO 25, ILLINOIS

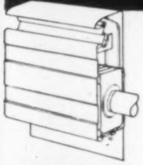
"IF IT'S KRITZER, IT'S RIGHT, SIR!"

- ★ CUTAWAY DRAWING shows Exclusive Kritzer Features
- ★ Full line of accessories
- ★ COVERS — 6 types with dimensions
- ★ RATINGS — one and a half pages of Kritzer Coil figures
- ★ How to plan an installation
- ★ Piping suggestions
- ★ Tips on installation
- ★ Specifications

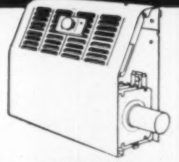
NOTE: Please send your request on
your company letterhead to:
KRITZER Radiant Coils, Inc.,
2901 Lawrence Avenue, Chicago 25

WHOLESALERS! Ask your Kritzer representative to show the film on Kritzer Radiant Baseboard at your next sales meeting.

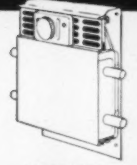
KRITZER QUALITY HEATING PRODUCTS



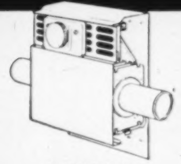
"K" LINE BASEBOARD



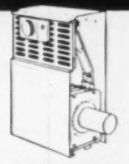
SLOPE TOP BASEBOARD



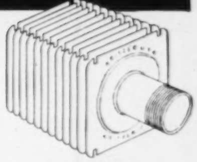
STANDARD BASEBOARD



UNIVERSAL BASEBOARD



CONVECTOR, SLOTTED FRONT



KRITZER FINNED TUBE

KRITZER

REPRESENTATIVES IN PRINCIPAL CITIES
SEE YOUR JOBBER FOR KRITZER PRODUCTS

"IF IT'S KRITZER, IT'S RIGHT, SIR!"

How the Remotaire Heating-Cooling System reduced air conditioning installation and operating costs in this skyscraper

• American-Standard Remotaire room units, operating in conjunction with an interior ventilating system, keep the temperature just right in the new 1430 Broadway Building owned by M. Lowenstein & Sons, New York City. The Remotaire units heat, cool, filter and recirculate all the room air while a separate ventilating system brings fresh air into the room.

Installation costs are reduced because this efficient Remotaire System requires only a simple piping system, eliminates space-consuming risers, reduces bulky ductwork, and cuts down the size of the fan rooms.

Operating costs are substantially reduced due to the flexibility of this system to meet varying seasonal or use requirements. Several units or all units may be operated with equal efficiency.

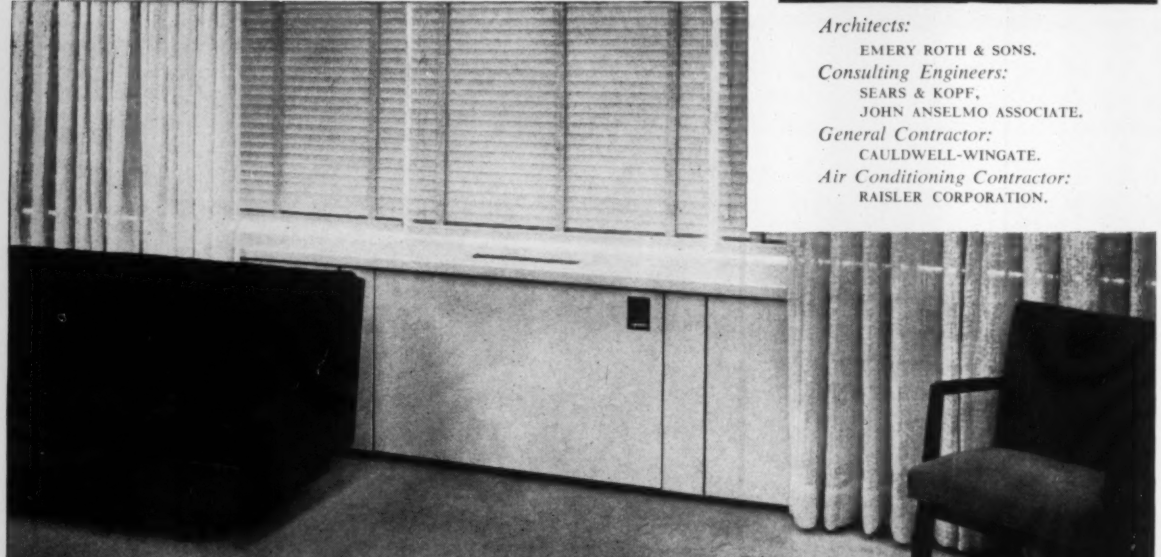
Remotaire Heating-Cooling Systems can be adapted to fit the needs of all types of buildings—old or new. Units come in a wide range of capacities and models to recirculate all the room air or to blend it with outside air. And Remotaire Systems take up little space because a simple piping circuit carries hot or chilled water from a centrally located boiler and water chiller to each individual room unit.

For more information about the complete Remotaire System — room conditioners, boilers and water chillers — call your American-Standard sales office or write to the Plumbing and Heating Division of American Radiator & Standard Sanitary Corporation, P. O. Box 1226, Pittsburgh 30, Pa.

AMERICAN-Standard

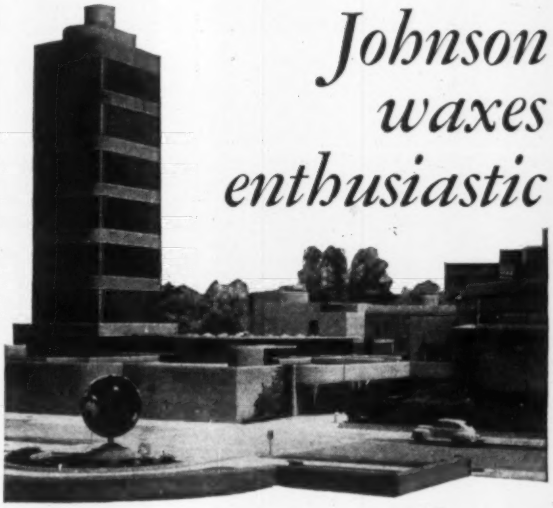
WATER HEATING-COOLING SYSTEMS

Architects:
EMERY ROTH & SONS.
Consulting Engineers:
SEARS & KOPF,
JOHN ANSELMO ASSOCIATE.
General Contractor:
CAULDWELL-WINGATE.
Air Conditioning Contractor:
RAISLER CORPORATION.



For greater operating efficiency, the 1003 Remotaire units in this 22-story building were divided into an interior zone, where the load is relatively stable and an exterior zone, where the load varies with outside conditions such as solar radiation. Temperatures can be individually controlled in all rooms equipped with Remotaire units.

Johnson waxes enthusiastic



about SNAP*ON

In the strikingly modern plant of the Johnson Wax Company in Racine, Wisconsin, molten wax flows through an extensive maze of piping. Steam tracers coil about the piping to keep these waxes fluid, and of course, insulation is a "must".

To insulate this piping, the Johnson Company selected lightweight G-B Snap*On, the one-piece molded pipe insulation of fine glass fibers. The fact that Snap*On is reusable was important to the company, since piping is frequently changed around to accommodate new processes. Johnson people were equally pleased with the ease of application and the snug fit of Snap*On over steam traced lines. And Snap*On's thermal efficiency — highest of any pipe insulation on the market — was still another deciding factor.

Because it is an all-purpose pipe insulation, Snap*On, with a vapor barrier jacket, was also selected to insulate chilled water lines in the Johnson plant. Snap*On is available in a wide range of pipe sizes up to 33", in a variety of wall thicknesses and jackets. If you, too, are looking for a new and better way to insulate cold or heated piping where temperatures do not exceed 350° F, write for the full story, on Snap*On . . . today!

GUSTIN-BACON *Manufacturing Company*

Thermal and acoustical glass fiber insulations • Pipe couplings and fittings • Molded glass fiber pipe insulation

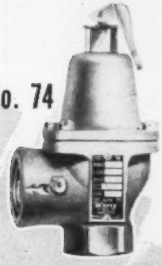
220 W. 10th St., Kansas City, Mo.

WATTS PRODUCTS

. . . for Boiler Heating Systems

For heating systems whether by hot water or steam, Watts pioneering research and engineering skill have produced protective and controlling devices that make water heating systems safe, efficient, automatic . . . Watts manufacturing efficiency and excellent workmanship provide you with quality controls, which enable you to render real service to your customers. Protect systems by installing the most advanced controls and safety devices.

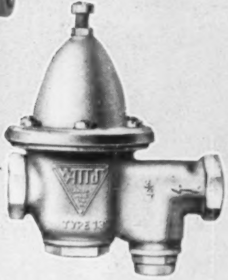
SAFETY IS A MORAL OBLIGATION



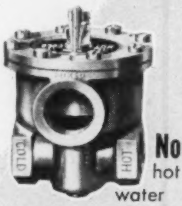
No. 74

No.174

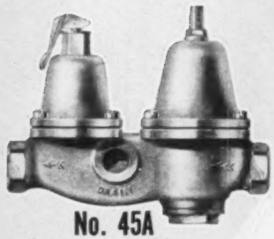
Nos. 74 and 174 series ASME boiler safety relief valves sizes 3/4" thru 2"



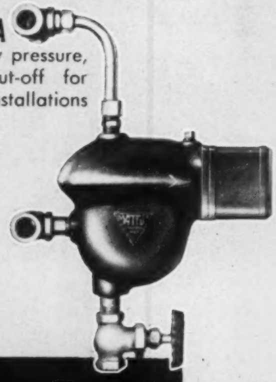
No. 135HW
feed water pressure regulator



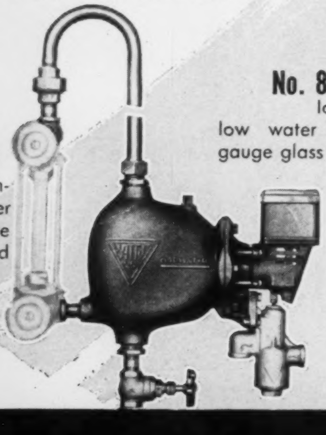
No. 71
hot and cold water tempering valve



No. 45A
hot water heating dual control de luxe all bronze construction



No. 89A
low pressure, low water cut-off for gauge glass installations



No. 60LWD
newly redesigned combined boiler water feeder and cut-off complete with mercury switch and gate valve drain

Since 1875

WATTS REGULATOR COMPANY

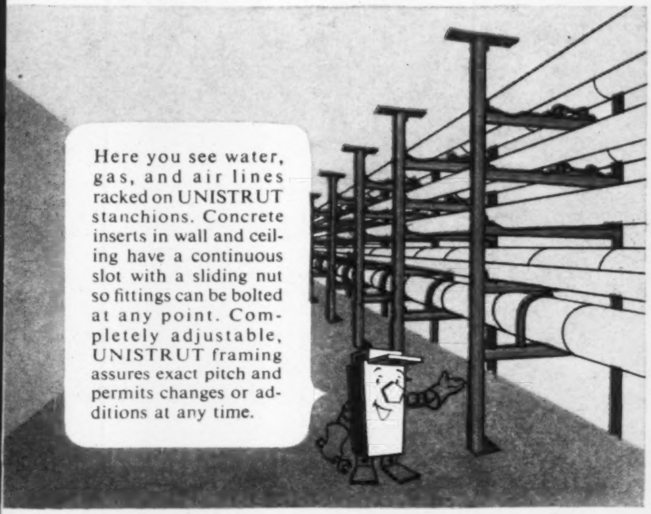
Plumbing and Heating Safety Valves and Controls

LAWRENCE, MASSACHUSETTS

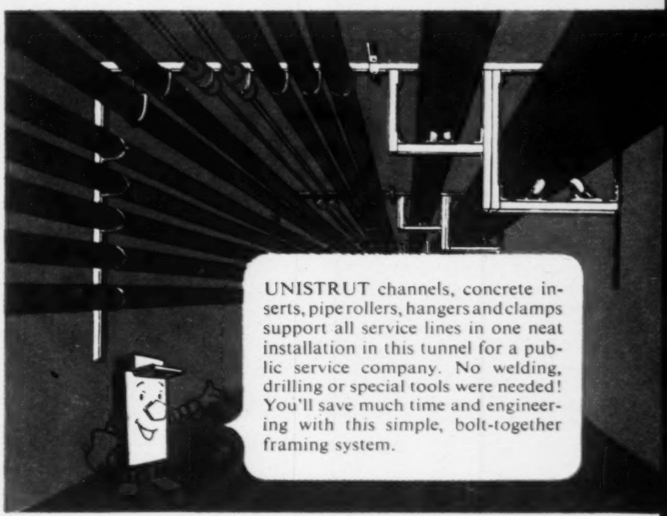
"The Sky's The Limit"

—when you build with UNISTRUT®

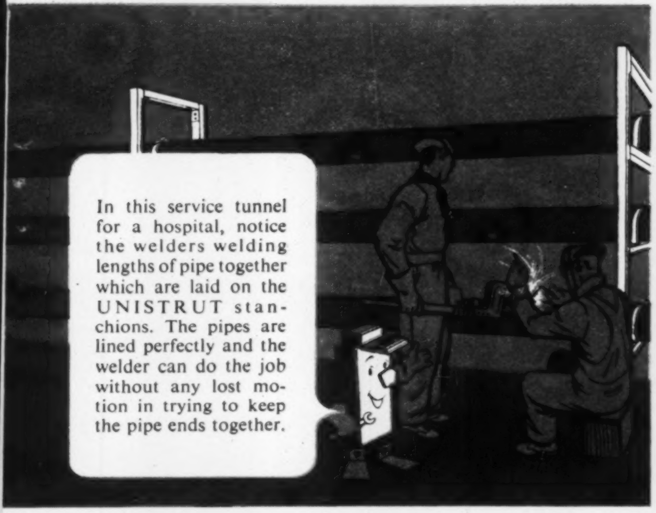
Mr. Strut cuts pipe racking costs four ways with UNISTRUT® framing



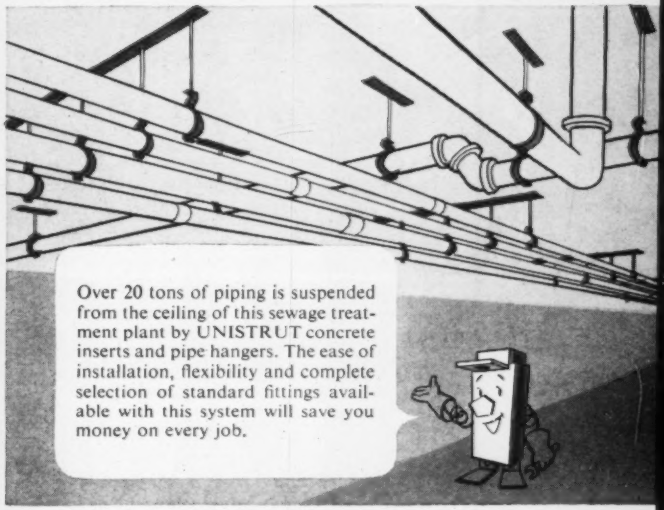
Here you see water, gas, and air lines racked on UNISTRUT stanchions. Concrete inserts in wall and ceiling have a continuous slot with a sliding nut so fittings can be bolted at any point. Completely adjustable, UNISTRUT framing assures exact pitch and permits changes or additions at any time.



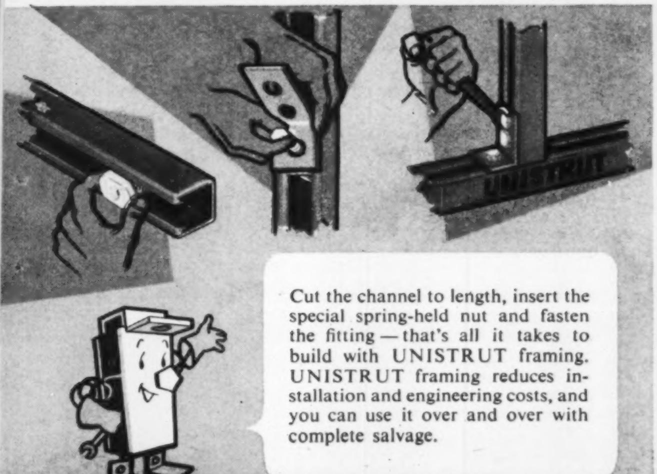
UNISTRUT channels, concrete inserts, pipe rollers, hangers and clamps support all service lines in one neat installation in this tunnel for a public service company. No welding, drilling or special tools were needed! You'll save much time and engineering with this simple, bolt-together framing system.



In this service tunnel for a hospital, notice the welders welding lengths of pipe together which are laid on the UNISTRUT stanchions. The pipes are lined perfectly and the welder can do the job without any lost motion in trying to keep the pipe ends together.



Over 20 tons of piping is suspended from the ceiling of this sewage treatment plant by UNISTRUT concrete inserts and pipe hangers. The ease of installation, flexibility and complete selection of standard fittings available with this system will save you money on every job.



Cut the channel to length, insert the special spring-held nut and fasten the fitting — that's all it takes to build with UNISTRUT framing. UNISTRUT framing reduces installation and engineering costs, and you can use it over and over with complete salvage.

Free Catalog!

Send today for your free copy of the 78-page catalog No. 700. Shows countless examples of how to rack, frame, suspend and support all kinds of mechanical and electrical equipment.

U. S. Patent Numbers

2327587 2541908 2329815 2345650
2363382 2696139 2380379 2405631

Other patents pending

UNISTRUT PRODUCTS COMPANY
1013 W. Washington Blvd.
Chicago 7, Illinois

Dept. H-7

Please send without obligation items checked below:

☐ Catalog No. 700 ☐ UNISTRUT sample

Name..........

Company..........

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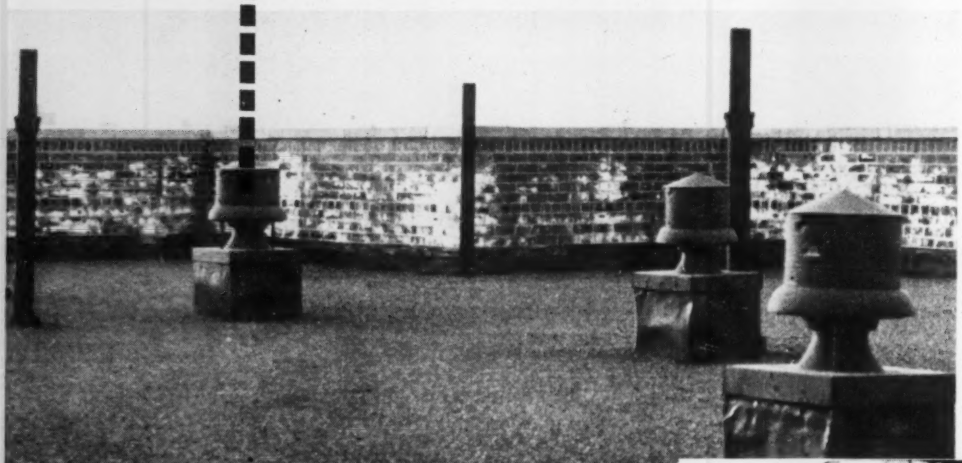
Problem **Ventilate efficiently 140 inside bathrooms**

Solution **Research-Designed *Gallaher Air-Vans*®**



When you have success with something, you're likely to try it again. That's what happened to Charles J. Wurmfeld, consulting engineer for the Woodrow Wilson Apartment House in Forest Hills, New York, when the construction plans called for 140 inside bathrooms. The contractors needed ventilators of *proven* ability, ventilators that could operate efficiently and quietly twenty-four hours a day *and* qualify for a certificate of occupancy.

Wurmfeld had used Gallaher Air-Vans® on other apartment houses, and he knew their reputation. He specified sixteen Gallaher units to connect with sixteen masonry flues, keeping the air constantly fresh.

Gallaher units arrive ready to install. Their low silhouette blends with the modern, luxurious lines of the apartment house design. But it is the performance that really counts, and Gallaher is performance-rated by actual physical test. Automatic dampers are not needed.

Overlapping umbrella outlets insure weatherproofing, and streamlined inlets insure quiet operation by reducing turbulance. For over sixteen months now the Gallaher Air-Vans® on the roof of the Woodrow Wilson Apartment House have been running quietly and efficiently without any trouble.

More and more engineers and architects are realizing the value of Gallaher Power Exhausters. The patented designs of the special scroll effect and the air seal-off, low silhouette, low noise levels, availability in special metals, weatherproof design—these are features that have made Gallaher the recognized leader in the field of industrial ventilation.
Direct Drive units 150-11,000 CFM. Belt Drive 3500-65,000 CFM, developing static pressures to 4".

For further information write

The GALLAHER Company

Patents 2188741 2526290
Patents pending

Pioneers in Research-Designed Power Roof Exhausters

4108 DODGE ST. **OMAHA, NEBRASKA**

Don't Overlook these BIG BABIES

...in the McDonnell 230 family!*

Perhaps the most popular pressure relief valve ever developed for hot water service is the McDonnell 230-¾ inch. In just a short while it has won a place on domestic heating boilers throughout the industry.

The same thing is happening to its big brothers pictured here. And for the same reasons. All of these conform to the ASME Code, and are Btu.-rated by the National Board. They have the same combination of dependability and economy. All have non-corrosive operating parts, and such refinements as testing levers that can't be tied down.

The manifold models blaze another trail besides. They are really two valves in one, for the really big boilers. They have a small unit which handles the everyday task of relieving thermal expansion without waste, plus another which stands by at all times ready to add its relieving capacity if emergency should strike.

Since bigger boilers represent bigger risks, keep these big-size pressure relief valves always in mind. You'll find an answer here for every job . . . the kind of answer you can't find anywhere else!

McDonnell & Miller, Inc., 3500 N. Spaulding Ave., Chicago 18, Ill.

Doing One M&M *Thing Well*

230 M-1

230
1 Inch

230
1½ Inch

*McDONNELL 230 SERIES PRESSURE RELIEF VALVES FOR HOT WATER SPACE HEATING BOILERS

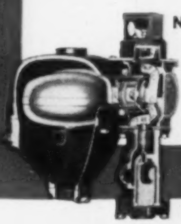
Boiler Size Btu./hr.	McDonnell Valve No.	Opening Pressure	Outlet (Internal)	Inlet (Internal)
303,000	230 ¾ Inch	30 lbs.	¾"	¾"
743,400	230 1 Inch	30 lbs.	1"	1"
1,025,100	230 1½ Inch	30 lbs.	1½"	1½"
1,488,000	230 M-1 {Includes 230 ¾ Inch 230 M36	30 lbs. 36 lbs.	¾" 1½"	2"
1,928,400	230 M-2 {Includes 230 1 Inch 230 M36	30 lbs. 36 lbs.	1" 1½"	2"

These Symbols appear on each Nameplate NB A.S.M.E. V UV

Feeders and Cut-offs, Too!

While a pressure relief valve is the primary safety device on a hot water heating boiler, it isn't the whole answer. Prolonged discharge through the valve, or sudden leaks in the system, or simple carelessness, can permit the water line in boiler to drop to a dangerous low level. Best modern practice calls for a low water cut-off like the specially designed McDonnell No. 63, or a water feeder like the McDonnell No. 247, or better still a feeder cut-off combination like the No. 247-2.

Write for engineering information



No. 247-2

No. 63

Your Jobber Stocks Them

McDONNELL *Boiler Water Level Controls*

A-C. MOTORS
POSITIVE protection
A-C. MOTORS
POSITIVE identification
RELIANCE
4 5 6
7 8 9
1 2 3

ON ALL NEW RELIANCE A-C. MOTORS

All new Reliance A-c. Motors provide these two essentials to trouble-free operation in hazardous or corrosive atmospheres . . .

POSITIVE PROTECTION

A pure neoprene gasket encloses each lead wire with an individually molded pressure knob. This gasket forms a positive protective seal between the motor frame and the corrosion-proof, cast iron conduit box.

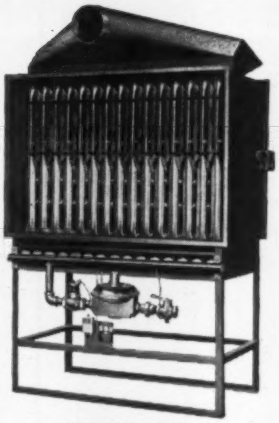
POSITIVE IDENTIFICATION

Numbers on the pressure knobs and lead lugs correspond with a numbered wiring diagram on the stainless steel nameplate. Identification for installing or rewiring is positive and easy.

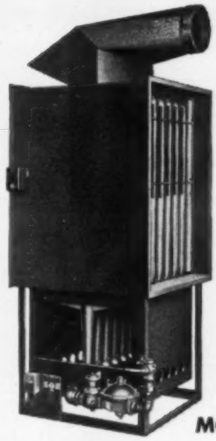
Another Reliance engineered development to assure industry a Totally-Protected, Precision-Built Motor!

Get in touch with your nearest Reliance sales office or distributor, or write for bulletin B-2401. *Reliance Electric & Engineering Co., 1052 Ivanhoe Road, Cleveland 10, Ohio; Canadian Division — Welland, Ontario.* B-1497

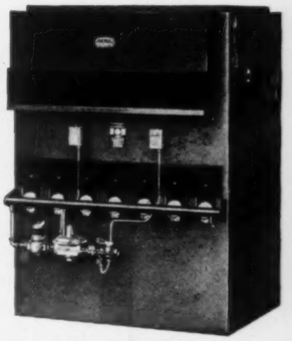
RELIANCE ELECTRIC AND ENGINEERING CO.



MODEL SED-E



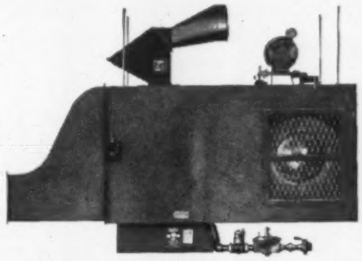
MODEL SED-S



MODEL SED-VF

MODEL SED-E — Non-corrosive type 321 stainless steel heat exchanger. Permits installation downstream of cooling equipment, for continuous blower operation. Air throughput in either direction. 80,000 to 600,000 Btu input.

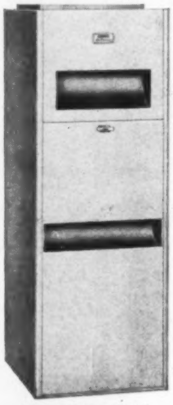
MODEL SED-S — Same as SED-E except controls are at the side, instead of at the end where accessibility requires either SED-E or SED-S is available in sizes from 80,000 to 600,000 Btu input in increments of 40,000 Btu.



MODEL SEU

MODEL SED-VF — Tested and approved as a duct furnace; type 321 stainless steel. Re-circulated or fresh air enters through bottom, sides, or back. Built-in air bypass, vent in front. Sizes from 70,000 to 245,000 Btu input.

MODEL SEU — Suspended unit heater. Recirculates room air. Diffuser outlet with adjustable vertical and horizontal vanes. Double inlet forward curve blower. Continuous duty, variable pitch drives, raised port burners. 80,000 to 600,000 Btu input.



MODEL SEC

HAYES

FURNACES

outstanding for
commercial, industrial,
schools, churches,
theaters, large residential

HAYES FURNACE MFG. & SUPPLY CO.
2929 So. Fairfax Ave., Los Angeles 16, California
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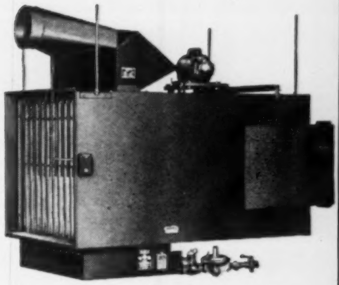

MODEL SES

MODEL SEC — Forced air furnace. Stainless steel heat exchanger sections seam and arc welded. One piece cast iron burners with drilled ports. Oversize double inlet blower, glass or washable filters. 6 sizes — 70,000 to 245,000 Btu input. For zero clearance.

REPRESENTATIVES

M. Blazer & Son, Passaic, New Jersey.
Blue Flame Supply Company, Atlanta, Georgia
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Boyd Engineering Co., Albuquerque, New Mexico And El Paso, Texas.
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Toy-Holbrook, Inc., San Francisco, California.
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Dealers Supply Company, Atlanta, Georgia.
Jewell & Company, Hot Springs, Arkansas.
Homer Maxey & Company, Lubbock, Texas.
Noland & Co., Newport News, Va.
Temp-Control Corp., Portland, Oregon

MODEL SES—Forced air, suspended furnace for installation in suspended duct system. Inlet and outlet designed for sheet metal duct connection. Double inlet forward curved blower. Continuous duty variable pitch drives, raised port burners.

Installing Bethcon air-mixing chamber in the air-conditioning and ventilating system of a large Western building.

HOW BETHCON IS BETTER

When you run into a tough forming or drawing operation, turn to Bethcon galvanized steel sheets. Bethcon's zinc coating is superior to that on regular galvanized sheets, and gives better results under extreme conditions. The reason: Bethcon is galvanized on Bethlehem's continuous lines, rather than by ordinary hot-dip methods. Resulting from years of research, the Bethcon coating solves many problems for sheet metal users.

TIGHTER — The Bethcon coating is more adherent and holds tighter to the steel. This means the coated sheet will take severe drawing or forming without flaking or peeling.

MORE UNIFORM — The zinc is distributed more evenly over the entire Bethcon sheet. The heavy zinc bead usually found on the drip end of ordinary galvanized sheets is eliminated.

BETTER LOOKING — The spangles on Bethcon sheets are bright, uniform and attractive in appearance.

Bethcon is made in sheets or coiled strip, 16-gage or lighter. Either plain carbon steel or Beth-Cu-Loy (copper-bearing) steel can be used for the base metal, depending on your requirements. You can readily get complete information on Bethcon galvanized steel sheets by calling or writing the nearest Bethlehem office.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

HM THE ONLY Matched

COOLING TOWERS and CONDENSERS

The Halstead & Mitchell Cooling Towers you select are *matched* by design to work with the famous Halstead & Mitchell water-cooled Condensers. You need no longer buy a high-efficiency cooling tower to work with a low-efficiency condenser (or *vice-versa*) . . . a long-life cooling tower to work with a short-life condenser (or *vice-versa*).

Remember that every cooling tower you sell is planned to work with a water-cooled condenser—then you'll see why America's leading manufacturers of air-conditioning and refrigeration equipment have swung to Halstead & Mitchell for their original equipment needs in both these components.

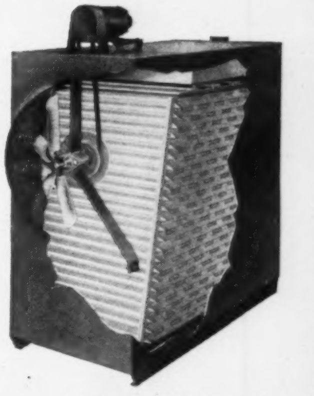
With cleanability you'll sell more. Why sell less?

20-Year Guarantee!

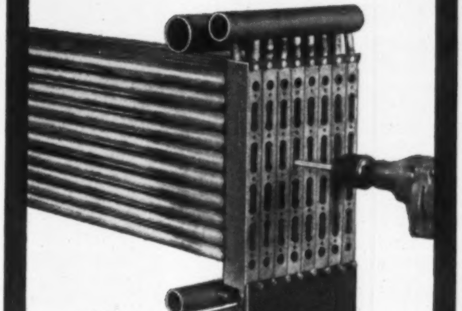
on the wetted deck surface against rotting or fungus attack

Only Halstead & Mitchell pressure-creosoting can provide a *guarantee* against immediate attack by fungus and marine parasites . . . or chemical deterioration from acids in water.

Added to this H&M exclusive are other major advantages. There's ultra-high efficiency in the gravity-type water distributing pan which eliminates extra pumping head required on spray type towers . . . and cuts down on water losses due to "atomizing" of water. And there's extra-long life in stainless steel fans . . . and sheet steel cabinets hydraulically painted with vinsynite, vinyl zinc and chlorinated rubber.



2 thru 120 TONS



1/3 thru 25 TONS

Lifetime Cleanability

The *mechanical* cleaning of H&M double-tube, counter-flow condensers means the simplest, least dangerous method of restoring new unit efficiency. Whether removing a heavy coating of sludge and scale, or a thin insulating film on the inner walls of the copper tubing, the mechanical cleaning tool restores heat transfer efficiency in a matter of minutes. The result is lowered discharge pressures . . . more heat carried off by cooling water . . . lower bills. *Only* the impurities are removed . . . the thickness of the copper wall remains intact, and the condenser gives extra years of peak service.

At Leading Heating and
Refrigeration Wholesalers
EVERYWHERE

Write for Detailed Specifications

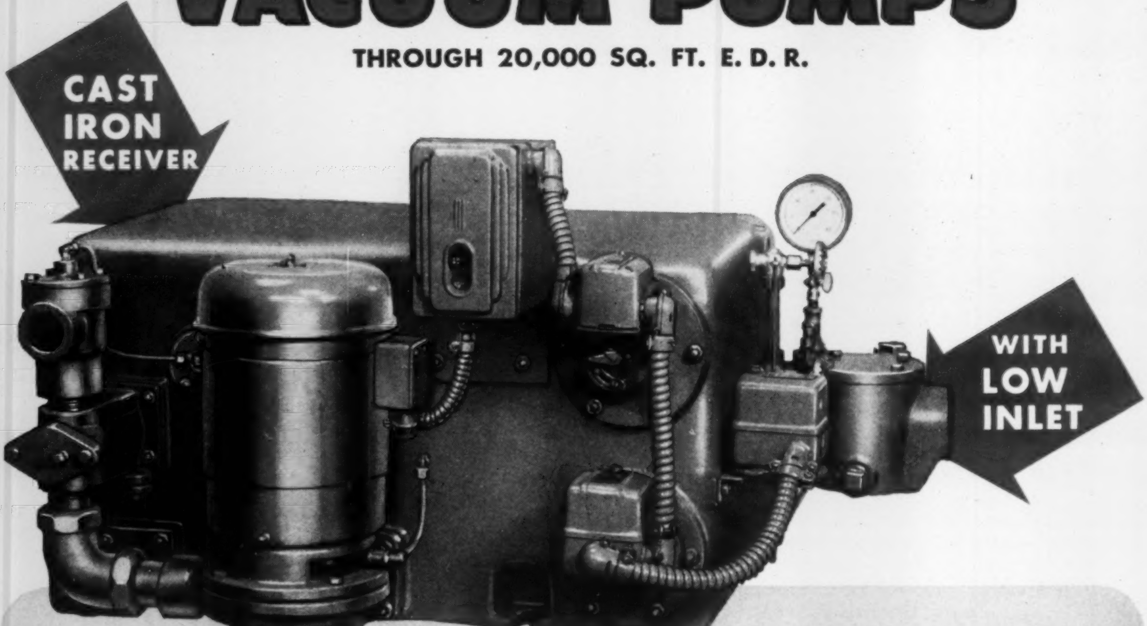
HM
Halstead & Mitchell

BESSEMER BUILDING • PITTSBURGH 22, PA.

HOFFMAN *IMPROVED DESIGN*

VACUUM PUMPS

THROUGH 20,000 SQ. FT. E. D. R.



SINGLE AND DUPLEX UNITS—RATINGS THROUGH 20,000 SQ. FT. E.D.R.

- **HOFFMAN FAMOUS JET VACUUM PRODUCER ASSURES GREATER EFFICIENCY—LOW UPKEEP.**
- **CUTS OPERATING TIME AND POWER BILLS APPROXIMATELY ½.**
- **ENGINEERED TO REMOVE UP TO 300% OF RATED CAPACITIES OF AIR AT START OF HEATING CYCLE.**
- **SHORTER WARM-UP PERIOD MEANS ECONOMIES.**

COMPLETE LINE OF HEATING PUMPS

VACUUM PUMPS THROUGH 100,000 SQ. FT. E.D.R. including units individually sized with separately controlled vacuum and condensate pumps for specific application.

CONDENSATION PUMPS THROUGH 150,000 SQ. FT. E.D.R. Watchman Pump—a small compact unit for systems through 8,000 Sq. Ft. E.D.R. and 20# pressure.

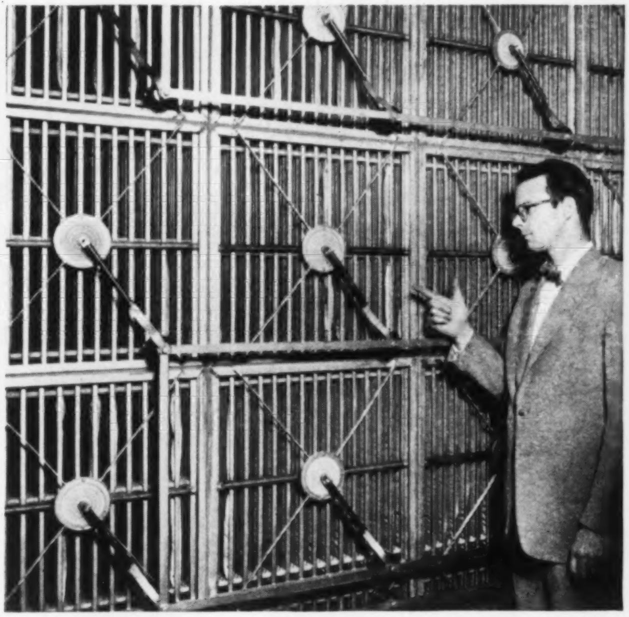
CAST IRON RECEIVERS ON ALL HOFFMAN PUMPS.

HOFFMAN Steam Specialties—Hot Water Specialties—Radiation Controls—Blake Plumbing and Drainage Products.

HOFFMAN SPECIALTY MFG. CORP.
1700 West 10th Street Indianapolis 7, Indiana

Entrance to General Offices, Brown Shoe Company, St. Louis, Mo.; Architect: Russell, Mullgardt & Schwarz, Van Hoefen; Engineer: Ferris & Hamig; Contractor: Kremer-Hicks.

Brown Shoe Company GIVES DUST THE *"Boot"*!



Rear view of typical Electro-PL installation serving each of building's six air conditioning systems.

AAF Electro-PL Electronic Filters Assure Clean Air For New General Office Building

CLEAN AIR is never an afterthought in the planning of modern, highly functional offices. In the case of Brown Shoe Company, dust and dirt are barred forever from their attractive, new St. Louis offices. Each of the building's six air conditioning systems, totaling 192,000 cfm, is equipped with Electro-PL Electronic Filters.

The Electro-PL is an AAF "exclusive"— a dry-type electronic unit offering twice the efficiency of ordinary dry filters—at low initial cost. Employing electronically charged Airmat media, Electro-PL's simplified maintenance requires no water or sewer connections—needs no oil to retain precipitated dust. Each renewal of the filtering media restores the Electro-PL to its original high efficiency. And, even in the case of power failure, this unit still maintains efficient filtration.

For complete product information, call your nearby AAF representative or write for Electro-PL Bulletin 257.

AAF

herman nelson

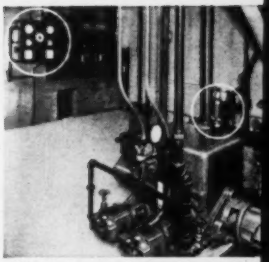
American Air Filter
COMPANY, INC.

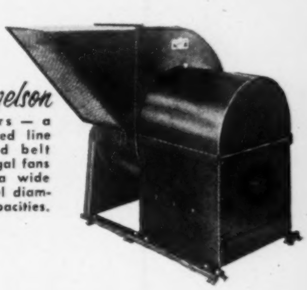
373 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.

AAF herman nelson

BETTER AIR IS OUR BUSINESS!

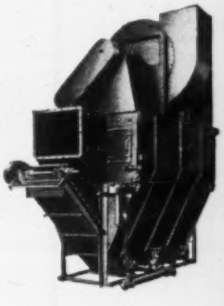
illinois Selectotherm — an automatically controlled high vacuum steam heating system which, through single dial control, balances heat supply against heat loss to provide even, constant warmth.





herman nelson Unit Blowers — a new, diversified line of direct and belt driven centrifugal fans available in a wide range of wheel diameters and capacities.

AAF Type N ROTO-CLONE—a high efficiency hydro-static precipitator designed for the collection of both coarse particles and extreme fines in excessive concentrations. Available in exhaust volumes up to 50,000 cfm.



American Air Filter Company, Inc.
373 Central Avenue, Louisville 8, Kentucky

I would appreciate receiving catalogs describing the following equipment—

- ☐ Electro-PL Electronic Precipitator
- ☐ **illinois** Selectotherm
- ☐ ***herman nelson*** Unit Blowers
- ☐ **ROTO-CLONE** Dust Control Units

Name____________________________

Company____________________________

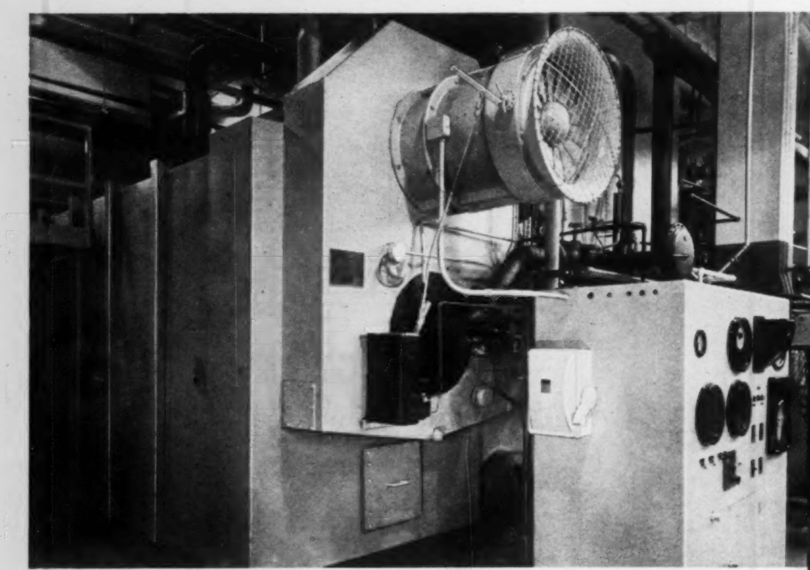
Street____________________________

City__________________State______

keeping steam cheap...

2 B&W FM Boilers Provide All Steam For New

Barberton Citizens Hospital



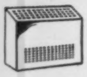
Dual unit installation of B&W FM Boilers in Barberton Hospital

Consulting Engineers:
William E. Bodenstein and W. W. Shuster

Architects:
Samuel Hannaford & Sons

Heating, Ventilating, Plumbing:
T. O. Murphy Company

Air view of new Barberton Citizens Hospital



HEATING

HOT WATER

STERILIZERS

KITCHENS

LAUNDRY

The opening of the new 251-bed Barberton Citizens Hospital in Barberton, Ohio, was the proud climax of an intensive ten-year community effort. Incorporating many original ideas as well as design features proved in other modern hospitals, the building and its facilities are as advanced as research and progressive design could make them. Virtually a small city, Citizens Hospital has its own pharmaceutical center, drug store, gift shop, power plant, accounting office, a restaurant capable of serving 37,000 meals a month, and a laundry that can handle 13½ pounds of linen per patient, per day.

Aware of the importance of assuring a reliable and economical steam supply that will fully meet the demanding requirements of hospital service, Barberton Citizens Hospital installed two B&W Integral-Furnace Boilers, Type FM, to meet all steam requirements. The boilers are gas-fired with provision made for using oil as stand-by fuel. The units are automatically controlled to operate under minimum supervision. They have a combined capacity of 41,000 lb of steam per hr, sufficient to supply an additional patient wing if one is built in the future. The present building has a total of 560 rooms for all purposes. The FM Boilers are easily providing all the steam needed for heating, hot water, restaurant, laundry, and sterilizing requirements.

Like this new hospital, many other institutions as well as commercial and industrial users have found the compact, shop-assembled FM Boiler ideal for small to medium steam loads. It is available in standard sizes for loads to 40,000 lb of steam per hr at pressures to 235 psi—may be obtained for higher pressures and with moderate superheat. Get the advantages of this versatile, economical unit if you are planning new construction, modernization, or expansion of your existing steam facilities.

For a detailed, illustrated description of the B&W FM Boiler write for Bulletin G-76A. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

COST-SAVING FEATURES of the B&W Type FM Boiler

- Saves Erection Time and Cost
- Meets Wide Range of Service
- Handles Quick Load Changes
- Fast Steaming
- Low Maintenance
- Easy Accessibility
- Suitable for Outdoor Service
- Burns Oil and/or Gas
- Saves Fuel
- Saves Space
- Safe, Automatic Operation

BABCOCK & WILCOX

B&W

BOILER DIVISION

G-709

THE EDITORS' PAGES

● *ATOMIC SHIPS can't run without atomic engines. In Congress, the battle for appropriations which last month threatened to create a breach in the president's atoms-for-peace program, has ended in scuttling the proposal for the atomic powered merchant ship. However, another part of the atomic energy program is going full speed ahead — producing the fissionable materials. Piping for the Portsmouth Area atomic project is covered in HPAC's report on page 91.*

Construction Contracts Higher Than Last Year

. . . 13 percent above

Future construction in the 37 states east of the Rockies, based on the latest contract award figures, is running 13 percent higher than the contract total a year ago, according to the F. W. Dodge Corp. The total for May was $2,185,065,000.

The first five months' total of $9,727,562,000 set a new high record and was 29 percent above the corresponding figure for last year, which reached the previous high mark.

For the second successive month, the residential classification topped the billion mark. At $1,011,310,000, residential building contracts were up 23 percent above the total for May 1954. It was the second highest in history, exceeded only in April of this year.

Nonresidential building totaled $725,755,000 for May, up 8 percent over last year. Public works and utilities totaled $448,000,000, up 5 percent over a year ago.

For the five months the classified totals were: nonresidential, $3,289,895,000, up 20 percent over the first five months of 1954; residential, $4,505,626,000, up 38 percent; public works and utilities, $1,932,041,000, up 28 percent.

Construction Lags Far Behind Actual Needs

. . . Commerce Dept. sees problem

THE CURRENT RATE of construction of schools and hospitals and other public works is far below requirements for the next 10 years, according to the U. S. Department of Commerce. This is the consensus of recent estimates of various groups and agencies as to the volume of need for non-Federal public construction during the 10 years ending 1965.

If we continue at present rates, only two-fifths of the additional facilities needed by 1965 will be built.

School construction needs for the 10 year period are estimated at $41.5 billion. About $31 billion will be needed for increased capacity and replacement of elementary and secondary schools, including private and parochial classrooms. The rest will be for college and university construction, with an additional $2 billion needed for dormitory and other student housing needs.

The current backlog of needed hospital construction is $13.5 billion. Obsolescence and population growth in the next 10 years would require $7.5 billion more, or a total of $21 billion for civilian hospital needs.

An additional $1 billion is estimated for needed construction of health centers, clinics, and similar institutions.

Air Conditioning Profits, Volume Seen Lower

. . . in 1955 than in 1954

FOR THE air conditioning industry both volume and profits in 1955 may not be as great as in 1954, comments Cloud Wampler, chairman and president of the Carrier Corp., reviewing the picture. "Because of inventories carried over from 1954, new orders received by manufacturers for packaged equipment, especially room air conditioners, have not been as large, so far this year, as last," he says. "And the same is true of shipments.

"On the other hand, business has improved in the field of big air conditioning. Should normal weather conditions prevail this summer, the present year might well be better than 1954. But the probabilities are that both volume and profits will be somewhat lower."

Plastic Pipe Uniform Standards Being Set

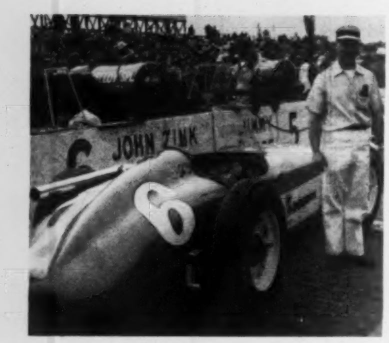
. . . project widely supported

DEVELOPMENT of national standards and uniform dimensions for plastic pipe has been initiated at the re-

Message Board Is Practical Idea

AN IDEA that appealed to us at the recent National District Heating Association convention in Chicago was the convenient and practical "Put and Take" message board at the entrance to the meeting room. To leave a note for another member, a person simply writes the message on a slip of paper and clips it to the board at the right, then chalks the name of the addressee opposite the clip. A reply may be promptly written and the new name entered on the board. Since members scan the board several times daily, it provides an efficient message center without red tape.

NDHA Put & Take
Messages Here
FOR
CHALK
Todays Events...



JOHN (JACK) ZINK, vice-president and sales engineer of the John Zink Co., Tulsa, and director of the company's racing team, stands proudly by the winning car in the 500 mile Indianapolis race. The car is owned by John Zink, president of the company

---

quest of manufacturers, consumers, and technical societies, according to the American Standards Association.

The project will establish a new Sectional Committee in the ASA to deal with tolerances, product markings, and shop tests for plastic pipe.

Electricity for Air Conditioning at White House

. . . is half of electric bill

Air conditioning accounts for more than half of the White House's $30,890 annual electric bill, according to Frank T. Gartside, assistant superintendent of the National Capital Parks. This was disclosed recently in published records of a House appropriation subcommittee's hearings on the 1956 budget for maintenance and operation of the White House.

A 400 ton central system was installed during the renovation and structural reinforcement program that was completed shortly before the Eisenhowers moved in. (See HPAC for February 1953 and June 1952.) Previously, separate packaged systems served each room or group of rooms where most needed.

Houston Holds Title of "Most Air Conditioned"

. . . 0.271 tons per person

There is 0.271 tons of air conditioning capacity installed in Houston for each person in that city, reports the Chamber of Commerce. Another Texas city, Dallas, ranks second with 0.221 tons per person. The Washington, D. C. figure is 0.113 and Philadelphia's is 0.112, according to the same source. Both Philadelphia and Washington report more tonnage for commercial air conditioning than does Houston, however.

Other air conditioning tonnage figures per capita are:

Atlanta	0.042
Detroit	0.090
New York City	0.018

Houston's total air conditioning tonnage is 277,864. Of this figure, 134,658 tons and 4930 installations are central commercial jobs using electricity, 4502 jobs representing 22,654 tons are central residential systems using electricity, and 107,509 tons are represented by window units. In addition, just over 13,000 tons are accounted for by gas-using installations.

Would Prohibit Non-conserving Air Conditioning

. . . hits water demands

Air conditioning can create demands on a water distribution system which will require excessive investments not otherwise required, according to C. Kelsey Mathews, principal engineer of Burns & McDonnell, in an address before the recent national convention of the American Society of Civil Engineers.

"The situation can be controlled by prohibition of non-conserving installations by ordinance," he said. "In the comparatively few cities which have observed the rapidly increasing demand for water for non-conserving units, prohibiting ordinance or changes in rate schedules have usually been put into effect.

Recommend Standards for Room Air Conditioners

. . . for advertising, selling

Standards for advertising and selling room air conditioners have been recommended by the Air-Conditioning and Refrigeration Institute and the National Better Business Bureau, according to the Institute.

The 16 point program is the result of more than a year of discussions between the two organizations. Nearly all manufacturers of room air conditioners and local Better Business Bureaus throughout the country were consulted.

The purpose of the standards is to encourage and preserve dependability in advertising and selling room air conditioners.

A major objective is the elimination of public confusion about the cooling capacity of room air conditioners by providing a single accurate, authoritative method of expressing such claims on a basis which can be readily verified. This will be done in terms of the Btu per hour capacity of the model as determined by a Standard established by the Air-Conditioning and Refrigeration Institute. This will apply for all 1956 models, or later. In the meantime, any statement of cooling capacity expressed in terms of the Btu per hour capacity of a unit shall be according to its rating based on the ARI standard.

The recommended standards define a room air conditioner as including "a prime source of refrigeration and dehumidification and means for circulating and cleaning air," although it may also include means for ventilating, heating, or performing other functions.

"Quote"

***"There is 23 times more energy in the earth's nuclear reserve than in all its conventional fuels combined. One lb of processed uranium contains the energy value of 1300 tons of coal or 230,000 gal of fuel oil."*—Atomic scientists' report, Westinghouse Electric Corp.**

Everybody talks about rising School Building Costs.. this South Carolina Engineer did something about it

Classroom in Edwards Elementary School, Chesterfield, S. C. Total sq. ft. 39,125. Cost (not including land, financial and legal) $282,921. Heating cost $23,179. Architect: James & DuRant, Sumter, S. C. Consulting Engineer: M. R. Durlach, Jr., Columbia, S. C. Heating Contractor: M. W. Turnage, Chesterfield, S. C.

M. R. Durlach brings real comfort heating to schools in the south, without costly frills

M. R. Durlach, Jr., Columbia, S. C. has used Tru-Perimeter Heating in more than 30 new South Carolina schools since 1952 . . . stayed within modest budgets . . . provided maximum heating comfort.

Webster Walvector, mounted along exposed walls, warms air in the room; warms floors and inside surface of outside walls; provides heating comfort everywhere — clean, gentle, even warmth . . . draft-free comfort with window ventilation . . . little temperature difference from floor to ceiling . . . Minimum piping, fewer risers, no hung ceilings or furred columns to conceal piping. And simplicity of design assures future low maintenance cost.

Call the Webster Representative for literature, or write us.

Address Dept. HP-7

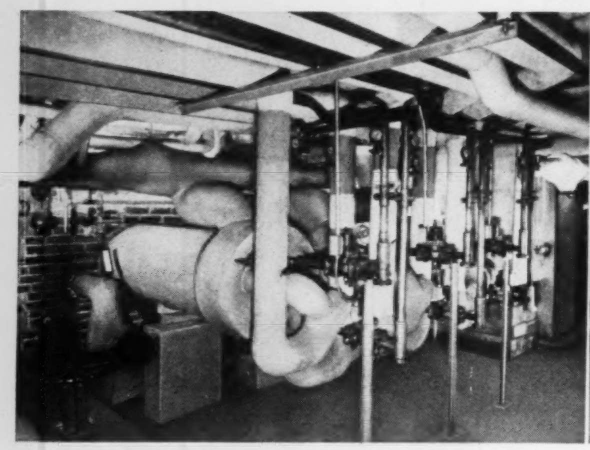
WARREN WEBSTER & COMPANY
Camden 5, N. J. : : Representatives in Principal U. S. Cities
In Canada, Darling Brothers, Limited, Montreal

SOME SCHOOL HEATING INSTALLATIONS ENGINEERED BY M. R. DURLACH USING WEBSTER WALVECTOR FOR TRU-PERIMETER HEATING

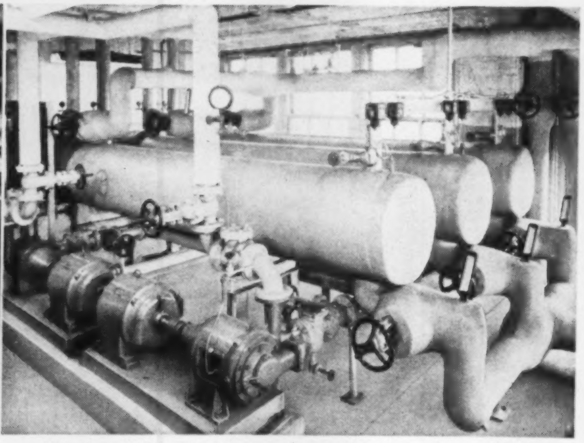
	Architect
Scott's Branch School Summerton, S. C.	James & DuRant
Robert Smalls High School Beaufort, S. C.	Heyward S. Singley
Newberry County High School Newberry, S. C.	Irvine B. Leslie
Wheeler Hill School Columbia, S. C.	James B. Urquhart & Alex A. Dickson
North Augusta Senior High School North Augusta, S. C.	Scroggs & Ewing
Macedonia School Blackville, S. C.	Lafaye, Fair, Lafaye & Assocs.
Hopkins High School Hopkins, S. C.	William Stork, Jr.
Bowman Elementary School Bowman, S. C.	J. W. Inabinet, Jr.
Pelion Elementary & High School Pelion, S. C.	Jesse W. Wessinger
Marshall Primary School Belton, S. C.	Ledbetter & Earle
Manning Training School Manning, S. C.	James & DuRant
Chesterfield Elementary School Chesterfield, S. C.	James & DuRant

Webster
WALVECTOR
REG. U. S. PAT. OFF.
For Steam or Hot Water Heating

AND Webster Hydro-Heat Baseboard; Convector Radiation; Heating and Process Steam Specialties; Moderator Controls for Steam Heating and controls for hot water heating; Steam, water and gas Unit Heaters. Data on request.



These three p-k Freon coolers, located in the basement, protrude through brick wall to save space.



Fifth floor installation shown here conditions upper floors. Third floor chillers serve cooling tunnels.

for perfect candy kitchen weather

LOFT'S USES p-k COOLERS

Schwerin Air Conditioning Corp. specified Chrysler Airtemp Units with p-k chillers to keep Loft's 8-story Long Island candy kitchen at just the right temperature and humidity for candy perfection.

You've seen soft, sticky, unappetizing candy you wouldn't want to eat. But you won't see it at Loft's. This big Eastern candy manufacturer has an unusual ability for maintaining the highest standards of quality 'buy-appeal'. And one important reason is its thorough-going air conditioning system employing Chrysler Airtemp units and six **p-k** dry expansion Freon coolers, engineered and installed by Schwerin Air Conditioning Corp., New York.

At Loft's both humidity and temperature must be rigidly controlled, for when humidity gets out of hand, candy is unsaleable.

So the reheating principle is used to cool the air, and "wring" it to the proper humidity. "Two-circuit" type **p-k** Freon coolers which chill a glycol solution are located in the basement and the third and fifth floors, to serve nearby areas. Air from conditioned areas passes around coils chilled by the glycol solution and air temperature is reduced some 25°F. to 43°F. A water spray cleans the air, and increases its humidity to 97%. Then the air is circulated around heating coils where its temperature is raised to 60°F. and humidity reduced to 51%—just the right "weather" for perfect candy-making.

The six **p-k** Freon coolers are automatically controlled; operation is simple. Because the coolers are enclosed, the Loft system is a *clean* system. Compact **p-k** Freon coolers require minimum floor space, minimum insulation.

If you, like Loft's, have a tough "indoor weather" problem, **p-k** heat exchange specialists would be glad to assist. More than likely they'll have answers to your particular questions. Write today for illustrated literature and engineering suggestions.

The Patterson-Kelley Co., Inc., 770 Burson Street, East Stroudsburg, Pa.

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"OPEN FOR DISCUSSION"

• *WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors. Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

Article on How Piping Has Met Industry's Challenges Is Morale Builder

THE HISTORICAL PERSPECTIVE presented in G. W. Hauck's article, *Centennial Marks Piping Progress*, in the June HPAC, is a morale builder for those who have been serving in the piping industry for some time, and should be an inspiration for anyone who has entered the piping industry recently.

It is, indeed, gratifying that piping has met the challenge of exacting demands imposed by various industries in which it constitutes what the circulatory system is in an organism. And glimpsing into the future, it can be confidently said: "There will be no hardening of arteries."

W. A. PALM
Vice President,
Midwest Piping Co., Inc.

Assembling Weather Data To Make Air Conditioning Design Easier

REGARDING I. A. Naman's comments last month on my article, *Weather's Effect on Air Conditioning Load* (May HPAC), he is entirely correct in his assumption that more than one set of design conditions are sometimes necessary, depending upon the type of job and application of the system.

It is with this view in mind that the Technical Advisory Committee of the ASHAE on Weather Data, of which I am chairman, is attempting to assemble data from which a consulting engineer can evaluate in terms of probability of occurrence and, therefore, select any design temperature which he, as the engineer, would feel to be the correct condition.

The first of a series of such data, which consists of winter dry bulb temperatures, is expected to be completed for submission to ASHAE by the January 1956 meeting.

JOHN EVERETTS, JR.
Consulting Engineer
Charles S. Leopold

Warm Air Panel-Convection Controls Ventilation, Temperature Closely

REFERRING TO THE ARTICLE, *Warm Air Floor Panel-Convection Combined to Heat New School*, by G. L. Gendler, in the December 1954 HPAC, I would like to add the following to my comments which were published in the June HPAC.

The system described in Mr. Gendler's article has the advantage over straight floor panel heating in that it combines controlled ventilation with heating. With straight floor panel heating — either forced hot water or closed-circuit warm air — additional provisions must be made for introducing and tempering ventilation air (a substantial item of both first cost and maintenance).

With only about one-third of the required heat being supplied by the panel heating effect of the moderately warm floor, the room air temperature is more easily controlled during the critical periods of wide variations in heat demand due to sudden outdoor weather changes. A 30 by 30 ft classroom which has a slab floor only 4 in. thick has 300 cu ft of concrete in the floor. At 135 lb per cu ft, this floor contains 40,000 lb of concrete. Assuming 0.19 Btu per lb as the specific heat of concrete, it becomes evident that the heat content of the floor is substantially less. Also, the room air temperature control will probably be less troublesome when 65 percent of the room heat requirement is provided by directly-delivered convection air and only 35 percent by the panel heating effect of the slab.

GUY VOORHEES
Technical Secretary (Application Engineering)
National Warm Air
Heating & Air Conditioning Association

Ventilation Is Most Important Feature of Floor Panel-Convection System

I WOULD LIKE TO REPLY to A. L. Wales' comment in the June HPAC on my article, *Warm Air Floor Panel-Convection Combined to Heat New School*, in the December 1954 HPAC.

He states that for approximately the same initial cost a quality forced hot water panel system could be installed which would overcome the problems of heating school buildings built on concrete slabs. This is essentially true. However, the main point which Mr. Wales apparently missed was that the warm air floor panel convection heating system provides ventilation, which we have found, after a year's operation, to be the most important feature of the system.

For approximately the same cost as a heating system, you have both the heating and ventilating system.

We are planning similar systems to the one described in the article, but using hot water heating boilers and fan and coil units instead of warm air furnaces. We have found there is very little difference in maintenance.

G. L. Gendler
Consulting Engineer

Humidifying Air for Small Test Lab Avoids Condensation Problems

I would like to comment on the article, *Controlling Air Conditions in a Very Small Test Lab*, by Robert Greenwald, in the December 1954 HPAC.

Mr. Greenwald's description of the air conditioning system in the small Fostoria laboratory parallels our experience in similar compact laboratories. I wish to commend especially the use of the perforated ceiling for introduction and diffusion of the relatively tremendous air volume.

Our experience suggests that when steam injection for humidification is made directly into an air stream at 50 F, there will probably be troublesome condensation that might saturate the perforated ceiling. We would do the humidifying after the air enters the room where — if water appears — it can be disposed of without embarrassment.

Samuel R. Lewis
Samuel R. Lewis and Associates
Consulting Mechanical Engineers

Forced Draft Seen Better Than Induced Draft for Packaged Automatic Boilers

I enjoyed reading the article, *Forced or Induced Draft*, in the May HPAC, discussing the merits of forced and induced draft arrangements on heating boilers. We feel that forced draft is the better arrangement, certainly on the modified Scotch Marine boiler design, the basis for a packaged automatic boiler.

One incontrovertible argument against induced draft is the fact that most packaged automatic boilers employ forced draft arrangements. Induced draft arrangements are most vulnerable in three general areas:

Fan Maintenance. Induced draft blowers handle high temperature combustion gases. The draft wheel must be kept clean since any deposits on the blades from incomplete combustion will reduce air capacity and cause objectionable vibration from an unbalanced wheel. Specially cooled bearings must be provided because of the high temperatures involved. Entrained products of combustion further complicate bearing maintenance for induced draft blowers. The forced draft blower handles clean room temperature air at all times.

Air Volumes Uncontrolled. Induced draft blowers handle widely varying volumes of combustion air for the burner, depending on the temperature of the combustion gases. Since a blower is a volume-pumping device, more air is drawn into the combustion space during startup and during low-fire periods when flue gas temperatures are lower. There is thus no real control of combustion air. With forced draft, combustion air is constantly introduced in predetermined quantity right at the burner. A higher CO_2 can be consistently maintained at all output rates. Also, power requirements are lower.

Leaky Settings Undetected. Induced draft permits undetected leaks in the boiler settings since the combustion space is under negative pressure. Such leaks upset combustion efficiency and cleanliness and may be dangerously unsafe. Air is thus introduced at various points rather than at the burner, where combustion air is required. Since the stack is under positive pressure with either induced or forced draft, the possibility of combustion gases leaking into the boiler room is present no less with induced draft than with forced draft. With forced draft, sooting appears around any boiler setting leaks and can be immediately corrected.

S. D. Distelhorst
Sales Promotion Manager
Orr & Sembower, Inc.

Author Was Associated with Piping Co. When He Submitted Article on Piping

In my article, *Try These Rules for Easy U Bend Design*, which appeared in the April HPAC, it should have been noted that at the time I submitted the article for publication I was associated with Midwest Piping Co., Inc., and that the results given in the article were developed during the course of my duties with that company. The photograph which illustrated the article was provided from the files of Midwest Piping Co. and shows a U bend made by this company.

John E. Brock
Professor of Mechanical Engineering
U. S. Naval Postgraduate School

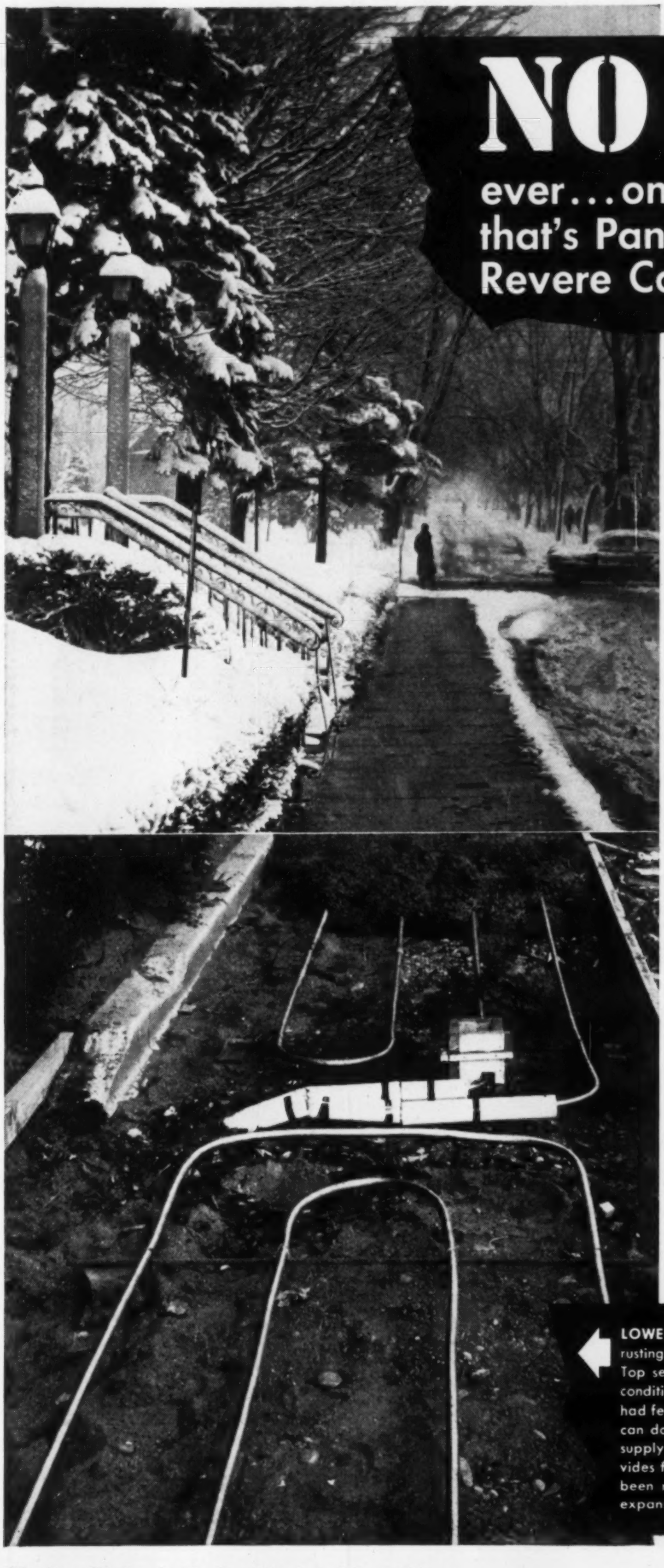
Author Explains "Croton," a Term for Service Water Connection in New York

Regarding the word "croton" in my article, *Central Heating Installations Yield Profit in Fourth Year*, in the May HPAC (line 3 of Table 2), the word is a term for a service water connection. Actually, it stems from before the days of high pressure water supply, when buildings in New York city had to depend on the Croton reservoir and the force of gravity to get water to the upper stories of buildings. (The reservoir is on the Croton river, about 35 miles north of the city, and still forms an important part of the city water supply.) The fitting which was used to connect the water supply from risers to fixtures on upper floors was called a croton fitting.

Norman C. Curtin
Consulting Fuels Engineer
Anthracite Information Bureau

NO SNOW

ever... on the sidewalk that's Panel Heated with Revere Copper Water Tube



Huge strides are being made by this method of snow removal. No wonder, shoveling and accidents due to snowy walks are eliminated . . . while the time and labor saved pays for the installation in short order.

That's why you'll find snow melting panels also being used on driveways, loading platforms, entrance aprons, service stations, pedestrian ramps at railroad stations, airports and similar spots. One application which bears special mention is the use of coils in garages. They quickly melt the snow on cars, keep floors dry as well as keep the repair shop floors warm so mechanics can lie right on the bare concrete in comfort.

And when you make the panels of Revere Copper Water Tube you have these added advantages: Copper can be bent to conform to the terrain. Bendability permits use of sinuous coils, while the 60-foot lengths of tube mean fewer fittings which, when joined by solder means joints that stay tight. Copper tube cannot rust, rot or deteriorate. That's why, on the inside, full flow and low frictional resistance are maintained throughout its long life. While external moisture will not harm it from the outside.

Keep ahead of the parade. Recommend Panel Heating for snow removal. Revere's Technical Advisory Service will be glad to help you in the proper application of Revere Copper Tube in working up your plans.

FREE! Instructive 16mm Full Color Motion Picture, "The ABC of Radiant Panel Heating." Write Advertising Department for details.

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COPPER AND BRASS INCORPORATED

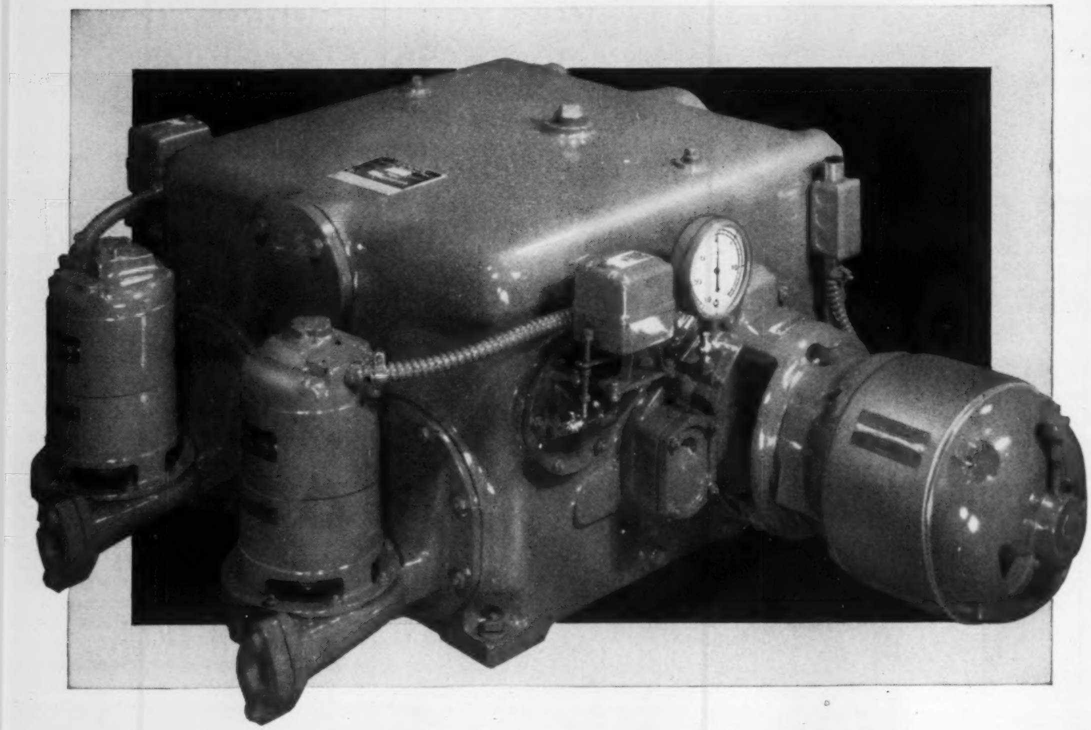
Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

Mills: Baltimore, Md.; Brooklyn, N. Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N.Y.
Sales Offices in ***Principal Cities****, Distributors Everywhere.*

LOWER SECTION OF PHOTOGRAPH shows how non-rusting Revere Copper Tube was imbedded in concrete slab. Top section of photo shows same walk under actual snow conditions. Note bends. Think of all the joints necessary had ferrous pipe been used. And think, too, of what seepage can do to rustable materials. Note insulation used on each supply and return line to the coils from the mains. This provides flexibility in the take-offs from the mains, which have been run below the slab, to allow for movement due to expansion and contraction.

THIS NEW VACUUM HEATING PUMP IS SIZED TO ACTUAL JOB REQUIREMENTS



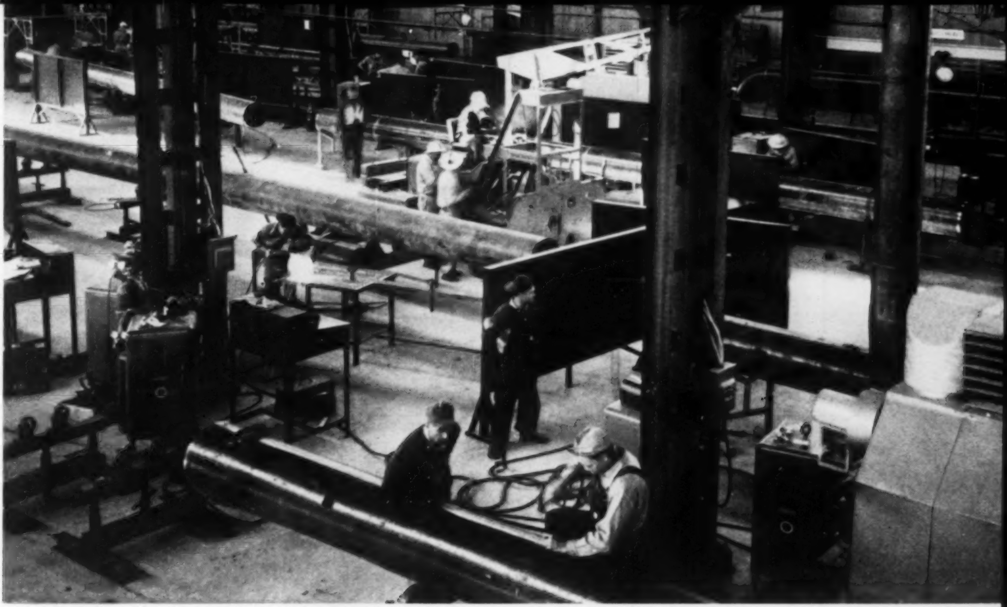
It's the Nash CSM

No longer is it necessary for the Engineer to accept a vacuum heating pump with air and water capacities based inflexibly upon square feet of equivalent direct radiation. With the flexible Nash CSM he can provide for proper air capacity in accordance with his judgment and experience. For the individual capacities of the separate pumps on the CSM may be varied within a wide range, without buying an oversize receiver and oversize water pumps.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low, returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- ✓ **Increased air capacity induces rapid system response without wasteful overheating.**
- ✓ **Separate air and water pumps individually selected to meet actual job requirements.**
- ✓ **Control system that operates individual pumps only when needed.**
- ✓ **Flexibility permitting addition of radiation without changing basic pump installation.**
- ✓ **Low, low, return line connection.**

NASH ENGINEERING COMPANY
438 WILSON, SO. NORWALK, CONN.



1 PIPE FABRICATION SHOP at the jobsite is the scene of one of the largest and most important operations in the construction of the Portsmouth Area plant

HPAC VISITS PORTSMOUTH AEC PROJECT

Piping the Atom

. . . requires mammoth installation for process and control

More than 1200 miles of piping and over 1000 miles of copper tubing are going into the huge \$1¼ billion gaseous diffusion plant at Portsmouth, Ohio. With construction still in progress after three years of work, over 100,000 individual piping assemblies and 225,000 pipe hanger assemblies have been fabricated. All piping is welded.

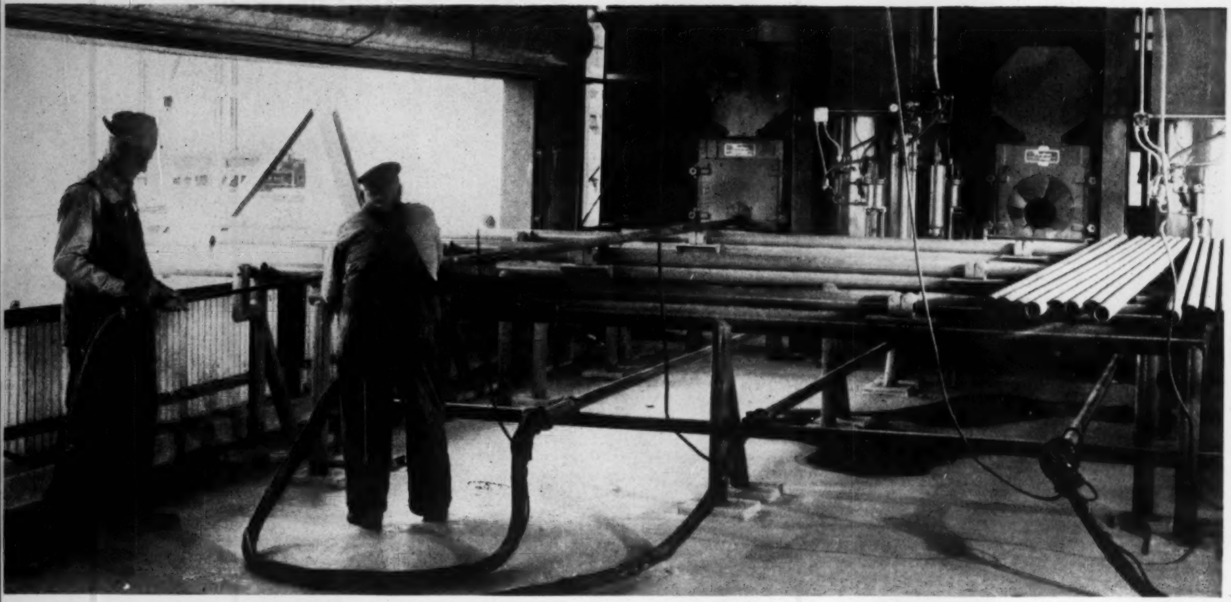
To join the crew of 6000 pipefitters and welders, welders must pass rigid qualifications tests, for which 80 booths are used. Fourteen new special welding techniques had to be developed to meet tightness and cleanliness specifications.

As each production unit is completed, it goes "on-stream" and begins the separation process for fissionable materials. Enormous volumes of gases must be re-cycled in several thousand stages in order to produce concentrated Uranium-235. The whole process depends upon piping.

SOME OF THE LARGEST industrial buildings in the world are those in the gaseous diffusion plant at the Portsmouth Atomic Energy Project, Pike County, Ohio. Here, immeasurably tiny particles of matter in mass quantities are produced. The production job is that of separating the two principal kinds of atoms found in normal uranium — Uranium-235 and Uranium-238. Natural uranium contains only one atom of U-235 to 140 atoms of U-238.

U-235, useful as an atomic weapon component or as a fuel in nuclear reactors, has been separated by the gaseous diffusion process in plants whose original units were built in deep secrecy during World War II at Oak Ridge, Tenn.

The purpose of the plant is large-scale separation of the uranium iso-



2 SANDBLASTING is but one method used to obtain meticulous cleanliness of all pipe and tubing. Wire-brushing, hot baths to remove grease, and capping and sealing ends of pipes, tubes, and assemblies are among others used

tope 235 from a chemical compound of uranium by the process of gaseous diffusion through porous barriers. These barriers must withstand a pressure head of 15 psi, contain billions of holes smaller than two-millionths of an inch which cannot be enlarged or plugged up as a result of corrosion or dust coming from elsewhere in the system, and must be amenable to manufacture in large quantities and in uniform quality.

The separation process involves several thousand stages, in each of which a portion of the gas — uranium hexafluoride (UF_6) — diffuses through the porous barriers and becomes enriched in U-235. The enriched product is then sent on to the next higher stage for further concentration. The impoverished portion is re-pressured and re-cycled through the next lowest stage. The total volume of gas re-cycled is enormous — over 1,000,000 times the volume of the enriched gas. In passing through several thousand stages, the U-235 is gradually concentrated.

Corrosion, Wear Are Abnormal

At the time Oak Ridge was commenced, no similar plant had ever before been contemplated. Essential tolerances and complexities were such that many advisors considered the plant impossible to build, and many more felt that even if built it would not work. Problems were encountered that called for excursions into the unknown far beyond any accepted method of design and construction. Development of some of the materials and equipment used in the plant was not successfully completed until after construction was well under way. In addition to its normal physical properties, equipment had to be selected on the basis of abnormal and unprecedented corrosion and wear conditions. Allowances also had to be made for changes in the fiber stress in certain metals.

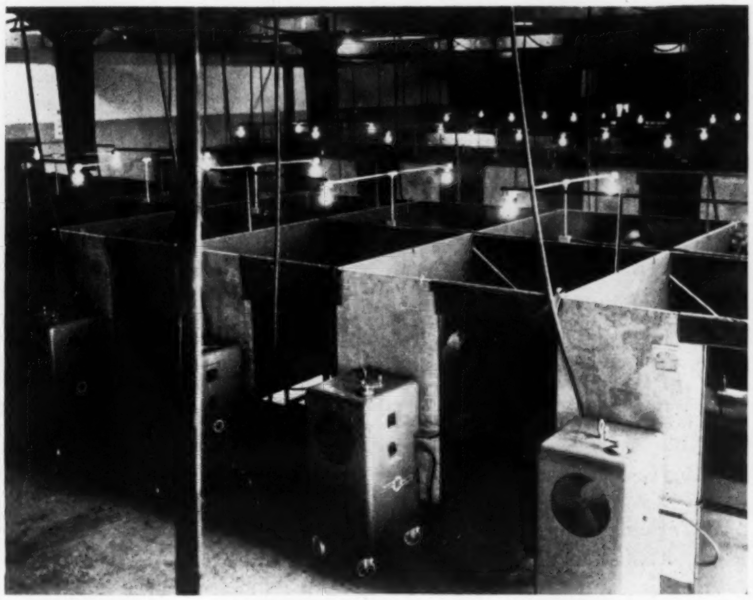
Miles of Piping Installed

The gaseous diffusion process for separating U-235 and U-238 depends upon piping to convey the gas from one stage to the next and also to control it. This required the installation of many miles of piping. Because of the highly corrosive nature of the uranium gases, all steel piping conveying them has a lining of pure nickel from 0.003 to 0.005 in. in thickness.

So important was the problem of producing welded joints to meet tightness and cleanliness specifications that it was necessary to develop 14 new special welding techniques. Installation of piping for the main process buildings exceeds anything of this type ever before constructed. Millions of feet of copper tubing are installed in the instrumentation system. The successful operation of such a plant is dependent largely upon the reliability of the instruments. The control must be precise in order that losses along the way do not make the process too expensive and impractical.

Develop New Techniques

Among the new techniques needed for the operation of the plant, stage compressors were developed to deliver at velocities greater than the speed of sound. It has been estimated that the time spent in research, development and the original design of these compressors alone totals 260,000 hours, or the equivalent of one engineer working 40 hours per week for 125 years. A new improved type of



3 WELDER TEST BOOTHS accommodate 80 welders, whose work on small pieces of metal is tested for quality and strength in the weld testing laboratory. There are 16 different tests given

mass spectrometer for isotopic assay and an electronic device called the "leak detector," which is remarkably sensitive, play an important part in insuring that all piping and equipment of the gaseous diffusion plant are vacuum tight. Industry eventually may reap rich rewards from technical advancements made in these and other fields.

It is anticipated that a demand of 1.8 million kw of power will be required to operate the completed AEC Portsmouth Area plant. Two new steam generating plants are being constructed in the Ohio River Valley, with a total capacity of 2.2 million kw, to supply this new AEC facility. One is near Gallipolis, Ohio, and the other is near Madison, Ind. When in full operation, the two power plants will provide a total of 15 billion kwhr annually. This is roughly two-thirds of the electric power consumption of the state of Ohio.

Build Portsmouth in 4 Years

Construction of the plant, which began in 1952, is expected to take about four years. It will have taken 120 million man hours to finish the project, enough to keep one man on a 40 hour week busy for 57,692 years. The plant is so designed that it goes into operation in units. As one production unit is completed, it is turned over to the operating contractor and goes "on-stream." Subsequent units are picked up on-stream as they are completed.

Before the mammoth project is completed, thousands of workers will have taken part in its construction. Approximately 22,500 workers were on the site at the peak of construction, and about 6000 of these were pipefitters and welders. When the plant is completed, between 3000 and 4000 workers will be required as operating personnel.

The floor area of the permanent buildings of the plant will total about 9 million sq ft, or approximately 210 acres. An additional 1.2 million sq ft of floor space will be included in temporary buildings.

Material and equipment to be utilized in the new plant is valued at $690 million and will include 87,000 instruments.

When the plant is completed, it will require a permanent water supply of 40 million gal per day. During construction, 2 to 3 million gal of water per day is needed.

Other requirements in building the plant include 595 miles of piping, nickel-plated on the inside, and approximately 600,000 lineal feet of welding on that type of pipe; 650 miles of pipe for auxiliary functions and utilities, with 300,000 lineal feet of welding for that pipe; and 1065 miles of copper tubing, with all joints silver brazed.

Piping Is Vital Link

One of the largest and most important single operations in the construction work being done is the fabrication and assembly of the thousands of feet of piping for installation in the huge process structures.

All offsite fabricated process gas pipe is received capped and sealed to prevent dust and other foreign material from entering during shipment and storage until the pipe is required for installation. It is then sent to the pipe fabrication shop, if necessary, and then combined with assemblies fabricated in the fabrication shop to form a specific erection package.

After final checking, the various packages are moved to the various buildings for installation by the pipefitters and welders. Approximately 100,000 individual piping assemblies were fabricated by the Jobsite Fabrication Shop prior to January 1, 1955. In addition to this, over 225,000 pipe hanger assemblies were completed in the same period.

Copper tubing is used for all instrument lines. Tube assemblies are also made up in the Fabrication Shop. All joints are made with silver solder, and to insure cleanliness all lines are purged with argon or nitrogen. Before fabrication, the tubing is straightened by stretching on a draw bench.

Pipe assemblies fabricated on site are subjected to various cleaning methods. One technique involves sandblasting and/or wire-brushing. Process pipe treatment for removal of grease and other contaminants inside each assembly is a hot bath of trichloroethylene, dilute acid, or alkaline solution. The assemblies are then sent through a rinse tank of 200 F treated water, dried, capped, and sealed, at which time they are ready to be installed in the system. Cleanliness is most essential, and this thought prevails throughout the entire operation.

All Pipe Is Welded

Every weld in the plant must be perfect. To control the quality of welds, every welder must pass a rigid test for qualification in the weld test laboratory. To insure that every weld is a perfect one, the piping subcontractor operates his own laboratory, which he set up.

A welder's own statement of his experience and what he can do with a torch is not enough. He must prove his ability under test. Even veteran welders who have worked on other atomic installations must pass the test before being assigned on the Portsmouth project.

Experienced welders who have worked all over the nation declare the Portsmouth Area testing lab is the most outstanding in the welding industry. There are many types of welders in the business, but not many possess the ability to pass the test on the first try. However, about 78 percent of the applicants finally do pass the test. In the early stages of plant construction, the average was about 30 percent.

In applying for a job, the welder fills out an application listing his welding experience. It is studied, and it is determined what type of welding the applicant is best qualified for. There are 16 different welding tests in all.

To pass all the tests, a welder must successfully weld carbon steel, stainless steel, monel metal, aluminum, and various other metals and alloys. He must also be able to do silver brazing. Heliarc, electric arc, and acetylene welding processes are used. Qualifying is done on the exact metals which are used in the plant construction.

The test lab has 80 booths for welding tests. Each is equipped with jigs to place the section to be welded in required positions. At the plant, welders work on pipe from 1/8 in. in diameter all the way up to 72 in.

Each welder is given a number which is stamped on his test specimens. After he completes a weld, it is passed along to the lab where it is tested for strength and quality. The specimens are called "coupons." Every coupon prepared by a welder is kept on file for future reference. The welder carries his number at all times after he is assigned to the project, and it is used to stamp his identification on every weld he makes in the plant.

Welding Procedure Detailed

The welding and stenciling procedure details for the project are given below:

1) All welded joints must be made using a minimum of three passes. Cover pass should exceed the width of "Vee," 1/8 in. on each side, with 1/16 in. minimum and 1/8 in. maximum reinforcement. (Crown)

2) All welding must conform to specifications in accordance with which the operator's qualification test was made.

3) All fit-ups must be checked for cleanliness and root opening by authorized personnel prior to welding. In addition to the above, process gas pipe and equipment must be checked for nickel plating.

4) All paint, rust and grease must be removed from weld area before welding.

5) All defects such as pin holes, undercutting, and slag inclusions must be removed and the entire weld wire brushed before any succeeding pass can be started.

6) After completion, all welds will be wire brushed clean, suitable for inspection, and under no circumstances will a weld be peened or hammered for any reason.

7) On all welds where a chill ring is required, the stringer must not burn through. Any burn-through must be reported to the supervisor, so that a new chill ring can be installed.

8) Pipe 4 in. in diameter and under cannot be flame cut except by special permission. Flame heat must not be applied to any pipe at any time.

9) To properly identify each weld, the operator must stencil the cover pass as indicated below.

a) Pipe 12 in. diameter or over, stencil quarter points. (Four places)

b) Pipe 4 in. diameter to 10 in. diameter, stencil opposite sides. (Two places)

c) Pipe under 4 in. in diameter stencil one place only.

d) All structural welds must be stenciled at an obvious place or places by any craftsmen making welds on permanent steel.

e) Silver brazing of instrumentation copper tubing or dissimilar metals must be stenciled as directed by field inspectors.

10) To properly identify a single weld made by different operators, each operator must block in each stencil beside the weld, indicating for which pass he is responsible.

For the acetylene booths, a new system of central acetylene distribution has been installed. Acetylene is piped to each booth from a central supply point, eliminating the work caused by tank exchanges.

Approximately 1200 welders were required at the project's peak.

24 Million Cfm Air Moved

In order to keep the chemical process lines and equipment up to reasonable operating temperatures, they are enclosed with 4 million sq ft of insulated panels. To prevent infiltration of dust or process gas into operating areas, the buildings are ventilated and kept under a positive pressure with 24 million cfm of filtered outdoor air. Five hundred large fans are used in ventilation, together with 14 million lb of sheet metal duct. To assure against leakage at sheet metal joints, 220 miles of caulking is installed.

The name of the piping subcontractor for this huge job is withheld by request. The ventilation and sheet metal subcontractor is George Koch Sons, Inc. The general contractor is Peter Kiewit Sons' Co., and the operating contractor is the Goodyear Atomic Corp.

OFFICERS, DIRECTORS AND CHAIRMEN of the NDHA shown are (left to right) *Front row:* Leo F. Collins, Norman H. Davidson, William G. Gillim, Walter M. Gillespie, Vernon J. Suche, John C. Haroldson, Albert F. Metzger, William R. Owen, John F. Collins, Jr. *Back row:* Jerome J. Collins, Robert C. Wilson, James W. Heaton, Carl W. Signor, Fred W. Deutsch, Arthur H. Sy, James C. Thompson, George K. Saurwein. *Not shown:* George F. Prestwich, Robert D. Martin, David W. Loucks, Clifford O. Thurlow, Foster L. Stephens, Edwin C. Cawrse, Robert H. Swoyer, Peter Barry

District Heating Steps Up Cooling Load

By John F. Collins, Jr.
Secretary-Treasurer,
National District Heating Association

• Greater demand for summer steam, due to the jet-paced growth of air conditioning and the current surge in office building construction, challenges members of the NDHA at Chicago meeting. Other subjects covered in more than 30 technical reports and papers were: sales development of district heating services, the need of more effective promotion of district heating, the continuing need of improved utilization of steam, and statistics reflecting the over-all growth of services by member companies during the past year.

WITH STEAM AND ELECTRIC UTILITIES facing the phenomenon of summer electrical loads surpassing winter peaks, representatives at the 46th annual meeting of the National District Heating Association in Chicago girded to meet the increasing demand for summer steam for air conditioning.

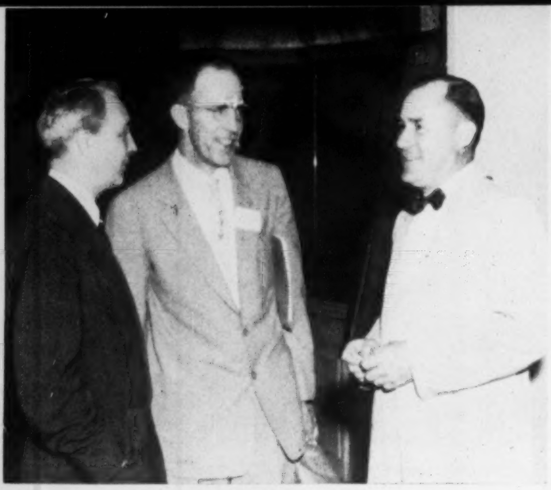
Most of the new office buildings constructed in Manhattan will require steam for air conditioning, said Robert D. Martin, general manager, steam service operations, Consolidated Edison Co. of New York, Inc. As chairman of the National District Heating Association's air conditioning committee, he gave some surprising facts and figures regarding the impact of air conditioning on the electric and steam loads of his company.

By 1959, he said, the steam department may be using all the low cost steam which can be spared by the electric department on hot summer days. With office building construction still surging upward, he estimates that the steam department will add air conditioning customers requiring 94,000 tons of refrigeration in the next five years. From 9700 tons in 1948, the contracted load has grown to 73,000 tons in 1954.

Loads of this type have been connected to the steam systems in four other cities, also.

Regarding the effect of air conditioning on the electric load, Mr. Martin said that, with clear hot weather, their 1955 summer maximum electric load would be about 180 megawatts below the winter maximum. However, should a thunderstorm occur on a hot day, the additional lighting load could raise the summer maximum above the winter peak.

The summer maximum load will increase, it is estimated, at an average annual rate of over 200 megawatts, compared to an increase of 100 megawatts in winter, so that in 1959 the summer peak will exceed the winter peak by 250 megawatts on a clear hot day.



BETWEEN SESSIONS Stanley L. Furber (right) explains to D. W. Loucks and C. W. Signor how individual office temperature control reduced steam consumption in Detroit's Buhl building

POST SESSION GATHERING of (left to right) Leo F. Collins, past president, Albert F. Metzger, general chairman of the meeting, and John F. Collins, Jr., secretary-treasurer of the NDHA, discusses demand for steam for air conditioning

It appears likely, he said, that the air conditioning load which will be added in the next two or three years will be considerably larger than the average predicted for each of the next five years. By 1975, when the air conditioning growth slows up, the summer peak will exceed the winter by 1100 megawatts, or 22 percent.

Introduce New Booklet

A new booklet, *Air Conditioning Guide for Office Buildings*, copyrighted by the Building Owners' and Managers' Association of Philadelphia and prepared by a joint committee of that organization and the Electrical Association of Philadelphia, of which Wirt S. Scott of NDHA's committee is a member, was introduced. The 24 page booklet contains much information a building owner should have in the preliminary stages of deciding on an air conditioning system. [Ed. note: Tables from this booklet comparing three basic air conditioning systems for office buildings were published as the Data Sheet in the May HPAC. Tables showing amortization and operating costs were given in the June HPAC.]

Absorption Chillers Advanced

Improvements made in absorption refrigerating machines were described by Victor Cole, of the Carrier Corp. He said that the new machines — essentially of the package type — are quiet, and that the changes which make them so have permitted the reduction of the motor on the solution pump from 25 hp to 7½ hp. No time is required now to start the machines, which may be done even by time clock. The units, he claimed, are now competitive in initial cost with electric equipment.

A new package control for application on absorption water chilling equipment was described by W. J. Hoeing, of Servel, Inc. The new control will not be incorporated in the absorption unit until it has been carefully field tested.

New Building Has Two Systems

In the closing paper on the air conditioning program, Edward L. Schulz, executive of John W. Galbreath and Co. — a firm engaging in construction and operation of large commercial office buildings for selected, long-term tenants — described the design features of the 4000 ton steam operated air conditioning system at the new Socony Mobil building in New York.

The 42 story building contains 1,300,000 sq ft of rentable area. Because of a severe setback above the 14th floor, it might be considered as two buildings — a 14 story block type building below and a 28 story tower section above. The air conditioning systems are separate.

For the block type section, turbine driven centrifugal refrigeration compressors are in the subbasement, and the air handling equipment is on the eighth floor. Absorption refrigeration units for the tower section are in the penthouse. These receive their steam supply from a bleeder connection on one of the turbines driving a 1000 ton centrifugal in the subbasement.

It is said that the selection of a split system saved $25,000 in steel, $45,000 on condensers, $12,500 in excavation, and $50,000 in chilled water risers.

The winter steam demand is estimated at 68,500 lb per hr, and the summer demand at 64,400 lb per hr.

Reports Sales Development

In his paper for the sales development committee, Robert L. Fitzgerald, vice-president and general manager of the Duluth Steam Corp., told of the start and expansion in Rice Lake, Wis., of a new district steam utility, something rare in recent years.

The Rice Lake Creamery Co., with a very modern creamery and a large boiler plant near the center of the city, has its greatest steam demand in the summer months when

Fuel savings of 20 percent were obtained by installing individual office temperature control in a Detroit building

the creamery business is at its peak. During the winter months the boiler capacity formerly was only partially used, but five or six years ago the creamery installed several hundred feet of underground steam line and began selling steam to a small number of heating customers. This proved to be a satisfactory arrangement for all.

Two years ago the city contracted with the creamery to supply steam to a new high school, then in the planning stage. The creamery and others organized the Rice Lake Steam Corp., which now buys steam from the creamery at the boiler room and sells it to the high school about a mile away and to others enroute.

The School Board, realizing that it could use steam service to advantage at other buildings — a thought which was also in the minds of officials of commercial establishments, including two other creameries — contracted for steam for both heating and industrial purposes; so 1½ miles of additional line had to be constructed.

The creamery plant contains two water tube boilers, each of 25,000 lb per hr capacity.

The underground steam lines are insulated with double-thickness glass fiber insulation, with a waterproof, tar-felt jacket protected by a 4 in. solid-pour envelope. The 4 in. and 5 in. mains cost only $11.23 per ft to install.

Perhaps there are many industries with summer peaks that could sell their spare steam in winter to advantage.

Commends District Heating

The vice-president of the Buhl Land Co., of Detroit, Ralph E. Thomas, a consultant on new building design and a trouble shooter in old buildings for the National Association of Building Owners and Managers, as well as a district heating customer himself, came to the meeting at the request of James W. Heaton of the Philadelphia Electric Co., chairman of the sales development committee, to offer the group some constructive criticism from the customer's viewpoint.

He first commended the industry for giving its customers "know how" information free, whereas other industries charge for it.

He said he had noticed that some utilities were much more promotion-minded than others in the steam end of the business. He urged that as much publicity be given to a good job done in the steam division as is given a similar job in the electric division. The front office, as well as the building engineer's office and the architect's, should be made aware of improvements. Utility engineers should be called in during the planning stage of buildings to get the most efficient system at the start.

He urged that the customers and prospective customers be thoroughly acquainted with such new items in district heating as snow melting and absorption systems for air conditioning.

Takes Pessimistic View

Speaking on the same program, I. L. Wise, Chicago consulting engineer, took a pessimistic view of the industry's immediate future. It was his opinion that the business, as we know it, will be out of existence because the 13 congested areas in which 77 percent of the steam sold goes to commercial users would themselves be no more, the victims of atomic bombs.

He recommended decentralization of the big cities and rebuilding in such a way that district steam would be used in residences, commercial establishments, and industry.

Study Degree Days Further

On the program of the commercial relations committee — headed by Carl W. Signor, of The Detroit Edison Co., — Edmund Bossone, of the Philadelphia Electric Co., presented the results of his study on the relationship between degree days and minimum temperatures in various cities. He concluded that there appears to be such a relationship warranting further study.

See Utilization Improved

Using steam equipment such as pressing machines, pressure cookers, absorption air conditioning units, laundering and other process equipment, and even space heating systems at pressures other than those for which they were designed, was the subject of a paper on the same program by John L. McKinley, of the Public Service Co. of Colorado. Mr. McKinley's conclusion was that when there is cooperation among the customer, the manufacturer of the equipment, and the supplier of the steam, it almost always is possible to make minor changes in equipment and operating methods so that the service will be satisfactory.

Office Control Saves Steam

In the final paper on this program, Stanley L. Furber, sales manager, commercial buildings market, Minneapolis-Honeywell Regulator Co., described the results in reduced steam consumption obtained in the 27 story Buhl building, Detroit, by installing individual office temperature control. Under the conditions designated, the savings in the use of steam were between 19.0 and 20.6 percent.

Fuel cost adjustments applicable in January 1955 were higher than they were for the same month in 1954 in some locations. In other areas they were somewhat lower, the predominant trend appearing to be a little downward, which agrees with the statistics committee report that the cost of fuel is a little lower. Steam heating service has been abandoned in two midwestern localities.

Report More Steam Sold

Foster L. Stephens, Allegheny County Steam Heating Co., Pittsburgh, chairman of the statistics committee, compiled figures from the reports submitted by 53 of the country's large district heating utilities. Total steam sold in 1954 was greater than in 1953. This is accounted for by the additional degree days in 1954 and, perhaps to some extent, by the new customers connected. The actual degree days, although greater than in the previous year, still remained less than normal.

The average gross revenue per 1000 lb of steam sold also increased in 1954 over 1953, due to rate increases and more sales in the higher rate brackets.

The principal fuel used, coal, decreased in cost per Btu while other fuels increased.

There was a decrease in total steam loss over 1953, indicating some progress by the utilities on one of their big problems.

The growth increase in number of customers, connected radiation, volume heated, line length, and capital invested were normal during the year.

Newly Elected Officers and Directors

At the closing session, the newly elected officers were inducted. For 1955-56, they are:

President, Vernon J. Suche, Union Electric Co. of Missouri, St. Louis.

First Vice-President, Walter M. Gillespie, The Dayton Power and Light Co., Dayton, Ohio.

Second Vice-President, John C. Haroldson, Duluth Steam Corp., Duluth, Minn.

Third Vice-President, William G. Gillim, Consolidated Edison Co. of New York, Inc., New York.

New directors for 1955-57 are:

Norman H. Davidson, Rochester Gas and Electric Corp., Rochester, N. Y.

Albert F. Metzger, Allegheny County Steam Heating Co., Pittsburgh.

William R. Owen, Central Station Steam Co., Detroit.

Remaining on the Executive Board are: retiring president Leo F. Collins, of The Detroit Edison Co.; George F. Prestwich, of the Philadelphia Electric Co.; Arthur H. Sy, of Adsco Industries, Inc., North Tonawanda, N. Y.; James C. Thompson, Georgia Power Co., Atlanta; and NDHA Secretary-Treasurer John F. Collins, Jr., of Pittsburgh.

Increase New Customer Revenue

In his report for the sales development committee, Sterling S. Sanford of The Detroit Edison Co., said that 518 new customers were added in 39 cities that are served by member companies. It is estimated that these new customers will require 2,385,041,000 lb of steam annually. At the average revenue of $1.25 per 1000 lb of all new business, this will bring in $2,974,521 added revenue to the suppliers.

While the number of new customers connected was smaller than in any recent year, the estimated revenue from them was higher than in any year since 1948.

Of the new customers, 22 percent had used district heating before, 59 percent are in old buildings using the service for the first time, and 19 percent are in new buildings.

The association divides its new customers into six classes. The group called manufacturing buildings, lofts, warehouses, printing houses, and garages accounted for the largest amount of new revenue. The next largest was accounted for by the group, office buildings, banks, etc.

Forty-four customers in 13 cities discontinued use of district steam in 1954 for some other method of heating. The loss to the utilities was $222,326 per year. The number of customers lost to competition was the smallest since 1946, and the revenue lost was the smallest since 1951.

In two cities the shutting down of steam plants, which also furnished electricity, resulted in securing $35,000 and $178,000 per year, respectively, in electric revenue, a greater total than in any year in the last 10.

The boiler capacity in seven cities is not adequate to serve new customers, and no additions are planned in 1955. In six cities the capacity is such that only a limited number of new customers can be connected. Elsewhere, the generating capacity is adequate. During 1954 boiler capacity was increased in four cities by a total of 631,000 lb per hr. In three cities, increases totaling 1,385,000 lb per hr are being made in 1955. This includes 1,000,000 lb per hr of existing capacity in an electric generating station which is being made avalable by the construction of a new steam main.

Inadequacy of distribution facilities forbids the addition of new customers in three cities, and in nine others only limited connections can be made. Elsewhere, there is adequate distribution capacity. In 16 cities, additions to the distribution systems were made in 1954, and in 11 cities extensions are planned for this year.

Steam Rates Went Up

Steam rate changes during 1954 in 96 communities were reported by Clifford O. Thurlow, rate engineer of Commonwealth Services, Inc., Jackson, Mich., chairman of the rates and regulations committee. He said that the percentages of increase in 15 cities were as follows: 3.4, 7.0, 7.5, 10.0, 10.4, 16.0, 22.6 to 24.3, 25.0, 33.0 and, in 6 cities served by one utility, 66.0 percent. There was one decrease amounting to 5.0 percent, in Fairbanks, Alaska.

John Collins' next report on the NDHA meeting, prepared especially for HPAC, will be published in an early issue.

NEW PRESIDENT Edward Jungbert, Louisville, accepts gavel from immediate past president of MCA J. DeWitt Morrow, Houston, (far right). Looking on, left to right, are other new officers: treasurer Joseph H. Spitzley, Detroit, and vice president George Hall, Madison, Wis.

Name Subcontractors in General's Bid

Heating, piping, air conditioning and ventilating contractors ask that they be named in general's bid on government work . . . UA to maintain labor jurisdiction "as it now stands" . . . other news of HPAC contractors Houston convention

A BILL before the Senate (S.1644) which would require general contractors doing federal work to name the subcontractors in their bids came in for a great deal of floor discussion at the annual convention of the Heating, Piping & Air Conditioning Contractors National Association (now the Mechanical Contractors Association of America) held in Houston. A similar bill proposed last year would have also required the general contractor to list also the dollar amount of each of the subbids. This bill did not reach a vote on the floor. The new legislation would require merely the listing of the subcontractors in each of the categories — heating, air conditioning, ventilating, piping, electrical, plumbing and other fixtures.

The Liaison Committee of the Mechanical Specialty Contracting Industries, which includes three contracting groups, sponsored both last year's and this year's legislation. Both are aimed to eliminate bid peddling, whereby a general contractor in a federal project could reduce his original subcontracting bids by calling in other subcontractors to do the work cheaper.

At Houston, it was revealed that the association's board had sent Senator Harley M. Kilgore, sponsor of the bill, a telegram asking that the bill be amended to include heating, piping, air conditioning and ventilation in one category—thereby insuring the recognition by the federal government of mechanical contractors being able to perform all functions. As it now stands, it was thought the bill might require a different bid, and hence a different contractor, for each category.

Durkin Sees Industry Advance

Martin P. Durkin, general president of the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada, was a featured convention speaker. As new developments in piping, he mentioned the use of isotopes to detect piping leaks and defects; the proposed use by railroads of piping systems, running parallel with the tracks, to ship liquids long distances in great quantities; and atomic energy power uses.

Mr. Durkin firmly declared that because his union wanted to continue to aid the total progress of the industry, that it would maintain its labor jurisdiction as it now stands. "We expect employers to keep step. I'm sure we will receive your cooperation, and I can guarantee you ours," he said.

Report $1¼ Billion Business

At the association's trade promotion panel, it was reported that, according to the annual overhead survey for 1954, a yearly poll taken among members, the annual business volume of the group was nearly $1¼ billion, of which $700 million went toward the purchase of materials.

Among the resolutions passed at the convention were one directing the board of directors to study the possibilities of the national office moving to Washington, D.C.; one asking the national association to take the necessary steps to have direct representation on the National Joint Board for Settlement of Jurisdictional Disputes; and one directing the association to gather information as to what benefical steps should be taken with regard to the Taft-Hartley act.

Registration for the convention, held in America's "most air conditioned city," Houston, was well over 500. Other actions at the meeting were reported last month, and elsewhere in this issue.

Downhill Technique Speeds Welding

Development and qualification of new procedure announced and discussed at piping contractors' meeting

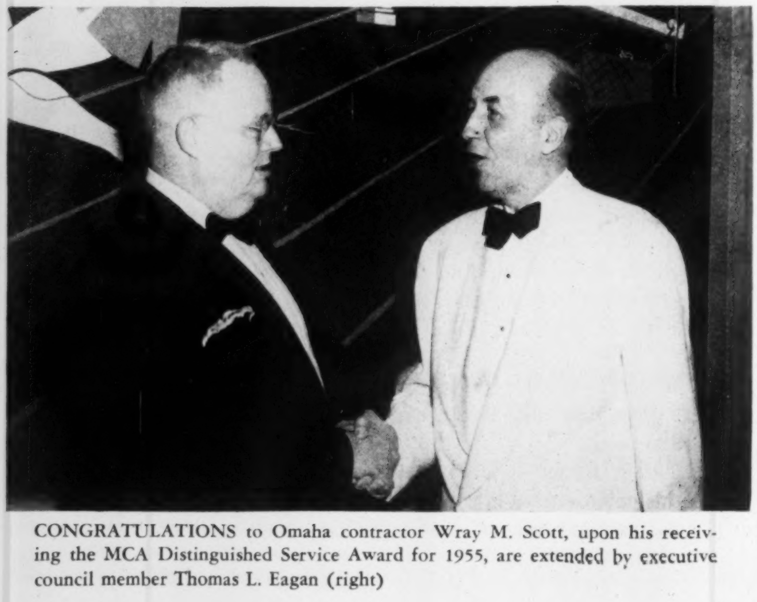
DEVELOPMENT and qualification of a downhill welding procedure for carbon steel pipe was reported by Wray Scott, chairman of the board of trustees of the National Certified Pipe Welding Bureau, at the 66th annual convention of the Heating, Piping & Air Conditioning Contractors National Association, held in Houston. (As reported last month, the name of the HPACCNA was changed, at the convention, to the Mechanical Contractors Association of America.) Downhill welding was also discussed at the informal pipe welding session sponsored by the association's committee on welding.

At this session, of which Richard S. Tobin was chairman, it was stated that 240 in. of welding per day "is the limit of journeymen in some areas, but that this will change when it is seen how fast the downhill technique is." It was suggested that, at present, "a fair day's work" might often be thirty 12 in. joints on cross-country transmission pipe lines, whereas on industrial plant or building piping it might be only three 12 in. joints.

In response to a question about use of downhill welding on chrome-moly pipe, it was stated by Mr. Tobin that, while a procedure had not been developed, it probably could be.

Suggest Welding Insert

Another question asked if it were possible to use inert gas, under a pressure of 1 in. of water gage or so, to control the shape of the weld — in chemical plant piping, for example, where an absolutely smooth inner surface might be required. The consensus was that, while this might be possible, it did not seem a feasible idea. Experiment on the part of each individual welding operator would be required. Use of a backing ring or welding insert which is consumed when the joint is properly welded was recommended as the best solution.



CONGRATULATIONS to Omaha contractor Wray M. Scott, upon his receiving the MCA Distinguished Service Award for 1955, are extended by executive council member Thomas L. Eagan (right)

Cite Training Manual Need

Need for "an up-to-date manual" for training welders, including the theory of welding, and coordination between the apprenticeship and welding committees of the association in developing new training material, was stressed at the session. It was suggested that the welding bureau and the welding committee be asked by the apprenticeship committee to revise material for training apprentices in welding.

Recent Progress Reported

In addition to Procedure 10 for metal arc welding of carbon steel pipe, fittings and flanges, which is based on the downhill welding technique, Mr. Scott — in his welding bureau report — reported a number of other developments:

Procedure 1—Metal arc welding of carbon steel pipe, fittings and flanges has been revised.

Procedure 2—Oxyacetylene welding of carbon steel pipe, fittings and flanges has been revised.

Procedure 1 was requalified in New York in the presence of the welding subcommittee of the National Bureau of Casualty Underwriters.

Developmental work is proceeding on revisions of Procedures 4 and 6 for chromium-molybdenum steels. These procedures are being revised to include an inert gas shielded first pass and completion with a low-hydrogen type electrode.

Procedure 11—Metallic arc welding of wrought iron pipe and fittings has been drafted.

Procedure 12—Oxyacetylene welding of wrought iron pipe and fittings has been drafted.

Heat Pump's Future Bright

. . . but good application, careful engineering essential, says speaker at contractors' meeting. Others describe dual duct jobs for office buildings, uses of packaged equipment

THE FUTURE for the heat pump as a means of air conditioning and heating buildings looks quite promising, said W. S. Miller, of the York Corp. Houston office, at the air conditioning panel session held during the annual convention of the Heating, Piping & Air Conditioning Contractors National Association (now the Mechanical Contractors Association of America) in Houston. However, available design data is inadequate, in his opinion, and heat pumps should not be applied indiscriminately or without careful engineering. "You can't take a standard package unit and apply it universally," he said. The larger installations appear to be more successful, he feels — perhaps because of more careful engineering.

Power Cost Is Factor

The best application for a heat pump is where the weather is mild, at least during the winter, and power costs are low. Cooperation of the power companies is needed, he feels. Unless power is available for 1c per kwhr or less, the heat pump "is not too practical." The heat pump is attractive to power companies because it gives them a rather uniform load, and because summer electrical peaks due to air conditioning "are very much of a utility problem."

Assuming a coefficient of performance for a heat pump of 4, and power at 1c per kwhr, Mr. Miller said that the "fuel cost" would be equivalent to 900 Btu gas at 40c per million cubic feet, 12,000 Btu coal at $11 a ton, or to straight electric resistance heating with power at ¼c per kwhr.

Air-to-Air Type Seen Limited

The source of heat is next in importance to the coefficient of performance and the power cost in deciding whether or not to use a heat pump, Mr. Miller said. The most common source is air. Limitations on its use are that at 40 F and with the higher outside humidities, the outside coil may ice up — and that less heat is available from the source when heat is most needed. He feels that air-to-air jobs are limited to the smaller applications, because of the bulk of the equipment.

Predicts Water-Earth Source

With water as the heat source, the problem is the availability of a constant supply. When using ground water, there must be a constant flow in the ground to take the heat away when cooling and supply it when heating. Water tables are decreasing in many areas; in his own well in Houston, the water stood 30 ft below the surface three years ago, is now 120 ft below ground level. As to city water, he said it was difficult "to name a place where there was plenty, or where disposal wasn't a problem."

The earth itself as a heat source or sink presents the problem of the ground area required, and the initial installation cost, he said. The type of soil must be considered, for "you can't dissipate much heat into a dry, clay type," as an example.

Probably well water — when available — is the best heat source, he stated, and he predicted a combination of the earth itself and the water table as a popular method for the smaller jobs in the future.

Another source for the heat pump is solar heat, although not too much attention has as yet been paid to it. (*Editor's Note*: A paper on design and economics of solar energy heat pump systems, by R. C. Jordan and J. L. Threlkeld, was published in the ASHAE Journal Section of the February 1954 Heating, Piping & Air Conditioning.)

Requires More Air and Water

Larger volumes of air or water for heating a building are necessary with a heat pump job than with a more conventional installation, Mr. Miller said. On one warm air heating job, he said the air temperature leaving the heat pump unit was 90 to 100 F. For a utility office building in Texas, two 75 hp compressors supply 107 F water for heating.

Good Applications Cited

A number of heat pump applications were mentioned during the discussion period following Mr. Miller's talk. A. J. Natkin, of Natkin & Co., Houston, said his company had put in a number of heat pump jobs, including a 10 ton installation on a boat using Gulf of Mexico water as the heat source. Another good application, he said, is a corner office which — because of its location — may have different heating or cooling requirements from the rest of the building. Five ton heat pumps have been installed in several such cases. A similar application is an office which is to be used when the air conditioning or heating serving the entire building is shut down (nights and week-ends, for example.) A doctor's examining room, where a quick change from cooling to heating may be necessary, was also mentioned as a good heat pump application.

Austin S. Ford (co-chairman, with William S. Bodinus, of the session) commented that "the ideal application for a heat pump would be in an office building located over a river."

Dual Duct System Is Flexible

At the same panel session, Walter O. Hoffman, of Buensod-Stacey, Inc., New York City, declared that although no one system can provide the answer to air conditioning office buildings, the inherent advantages of the dual duct system are creating a definite trend toward this type. It provides for individual room control regardless of variations or changes in thermal loads in any part of the building, exterior or interior.

The same fan that supplies the exterior areas can also serve the interior, and the dual duct system has the inherent flexibility, with separate hot and cold ducts, to permit this, regardless of thermal load changes, because warm and cold air are available at all times. There is no need for cycle change-over, he said, as required by systems using warm or cold air or water alternately in a single duct or water pipe distributing network. With this system, mixing units in each room draw air from both the warm and cold air ducts in any desired portion to satisfy individual room temperature.

Since there are two ducts, there is some tendency for the air volume to vary at each outlet. While this in no way affects the temperature control, it can disturb distribution and air movement. Therefore the volume is maintained uniform by one of two means: in the hot and cold mains by static pressure regulators, or zone control by volume regulators at each mixing unit.

In the cooling season, the warm air supply is maintained at about room temperature so that reheat is not ordinarily required, but it can be obtained in the separate warm air duct by economical reverse cycle means.

In the heating and intermediate seasons, cooling and dehumidifying are obtained economically, using up to 100 percent outdoor air. This system is so flexible, he said, that even a room with no internal heat load can achieve good control from the heat made available from loaded rooms.

He said that the dual duct system is particularly adaptable for air conditioning existing office buildings. The exterior areas can be coordinated with the existing heating system (thereby eliminating the necessity for removing the existing heating system). For details of the dual duct system, Mr. Hoffman referred his audience to the paper by R. W. Waterfill in the ASHAE Journal Section of the November 1954 Heating, Piping & Air Conditioning.

Packaged Units Evaluated

D. A. Forberg, of Air Comfort Corp., Chicago, said that the chief benefits of packaged air conditioning units in existing buildings are that they are flexible and adaptable for zone control, while keeping ductwork to a minimum. The cost of water piping in multiple installations would be met by savings in sheet metal ductwork, he said. Disadvantages are the need for floor space and a "slightly higher" noise level. A big market for packaged units is in supermarkets and where the tenant pays for cooling and heating.

In applying packaged units, Mr. Forberg said in conclusion that ratings of the many manufacturers "are all over the map." He also mentioned that many local codes require venting of the receiver, which sometimes presents a problem in getting relief lines outside.

"Harness Sun for Fuel To Avert Dilemma"

. . . conference is told

HUNGRY FOR ENERGY, America's economy must tune up technologically or face a serious dilemma in the near future, according to Dr. Eric A. Walker, dean of engineering at Pennsylvania state university, in a speech at a recent Michigan State University symposium on "Automation—Engineering for Tomorrow."

More materials, more energy, more manpower and more engineers are needed, he said. If America has a population of 200 million by 1970, it will be forced to import many raw materials, including 35 percent of its petroleum, 60 percent of its aluminum ore, and 42 percent of its iron ore.

Using the symbol *Q* as a unit of energy representing about 34 billion tons of the best grade coal, it now appears, he said, that from the beginning of time until now, civilization has used about 13 *Q* of energy. By the year 2000, the world will be using one *Q* per year.

"The best estimates are that we have underground less than one *Q* in oil and gas. We have some 68 *Q* of energy in coal, of which only about 6 *Q* can be obtained by present methods of mining," he said.

"Therefore, if fossil fuels were our only source of energy supply, we could expect that even within our lifetimes our fires might burn out, our generators might stop, and our homes might grow cold.

"Fortunately, we have two other sources of energy. First, we know that by present standards of technology, we have at least 100 *Q* stored in uranium. Second, we know that we can collect energy from the sun. The experts tell us that in three days the sun radiates on this earth sufficient energy to replace all of that stored in usable fossil fuels throughout the centuries past.

"Thus we have only to advance our technology to the point where the sun will move our machines and our energy bottleneck for the foreseeable time has been conquered."

SAM LEWIS' PAGE

Selecting Fuels for Heating

THE UTILIZATION OF FUELS for heating has come a long way from the era of sawing and splitting wood. Almost as great a span has been the advance in technology since my own boyhood, when we strip-mined and burned our own coal by scraping off the earth above bituminous deposits in a ravine on our Illinois farm. Now, for many years I have been designing coal burning heating and steam plants and have learned something about their operation and control. Along with these developments in fuel technology have been improved methods of cost accounting and changing labor requirements.

One particular steam boiler about 8 ft wide and 20 ft long has heated a five story department store through many winters. The combustion chamber had water tubes to act as the upper grate with conventional shaking grates spaced below them. Caking coal was piled deeply above the upper grate, and air for combustion was admitted above this coal and below the shaking grates. There was a passageway into the heat-absorbing surfaces of the boiler, from the space between the two grates. Heat from the fire on the lower grates warmed and may be said to have cooked the coal on the upper grates. Thus, there was a downdraft through the upper grates and an updraft through the lower grates.

As combustion progressed, fuel fell through the interstices of the upper grates to form a hot, nearly smokeless, fire on the lower grates. Given highly skilled attention, the chimney rarely indicated smoke. However, department stores generally keep the attendant busy in places other than the boiler room, and so the smoke prevention department of the city made much ado. As a result, since the skilled attention could not be given, I recommended that all of the grates in this boiler be removed, and that a forced draft underfeed stoker be installed. The vertical clearance between the stoker tuyere and the crown sheet of the boiler was increased more than 100 percent.

The coal delivery is by dump truck through the coal bunker roof. The stoker conveyor extends under the bunker, so that the entire bunker serves as a hopper. Thus, the only labor by the attendant is the periodical de-clinkering and the removal of fly ash. We hear of no more trouble from smoke.

A big manufacturing plant has an average metered steam demand of 30,000 lb per hr. High quality bituminous coal from a tall, mechanically filled, circular masonry bunker flows by gravity into a traveling self-weighing hopper. This hopper delivers the coal to a water-cooled stoker. The coal enters the combustion chamber in a shallow stream and burns progressively, as the vibrating stoker encourages its progress down the gently sloping grate, until at the rear end of the chamber the ash and thoroughly de-carbonized clinkers fall off into the ash conveyor hopper.

This mechanical removal system, with its gases vented to the chimney, delivers the clean ash to an overhead steel tank. At long intervals the ash from this tank may be hauled away. We have, of course, modern indicating and recording instruments, and the labor is reduced to a single man.

A large hotel requiring 72,000,000 lb of steam per year replaced two old coal burning water tube boilers and stokers with a single new boiler and oil burner. This hotel finds, after a year's operation, a saving of $23,000 per year in labor, despite a $10,000 increase in the cost of fuel. The $13000 per year saved in this case will quickly amortize the cost of the new boiler and oil burner.

A 40 year old plant in a high school had two 6 x 18 ft horizontal return tubular boilers, each equipped with a worm type underfeed stoker. The stoker hoppers were filled from a wheelbarrow and a scoop shovel, helped by a strong man on each shift. The boiler shells above the fire had bulged downward, as a result of high temperature and pressure. Coal per average year cost $9538 and the extra labor chargeable to coal cost $4100 per year or a total of $13,638.

Oil per average year cost $9123 without any extra labor, so that a yearly saving of $4515 was available to devote to the cost of the two new boilers that were installed to replace the three originals. The new boilers, oil burners and oil tanks that replaced the old timers cost $47,000. The new plant will be paid for in less than 10 years. In fact, allowing for interest on the yearly accumulation, the $4515 at the usual 0.0759 percent sinking fund rate for 10 years, would justify a $60,000 investment. Conversely, to pay off a $47,000 investment with a premium of $4515 every year, they have an 0.095 percent income, and the new plant will be paid for by the savings in well under 10 years.

Thus, it pays to study not only the basic condition of a heating plant but fuel and labor costs as well, in order for the client to benefit from true economy and efficiency.

SAMUEL R. LEWIS, consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors, comments informally each month on practical heating, piping and air conditioning problems.

A MINISTER TELLS WHY

Air Conditioning for Churches

By Morgan M. Miles

A LETTER from a friend informs me that my old parish church has just installed air conditioning, thanks to the Woman's Auxiliary, whose members finally got tired of sticking to the seats in hot weather. Or possibly it was to meet the competition down the street, which had already put in a form of air conditioning.

In any case, when I was there, the blistering Kansas heat poured over the tile roof of the church in summer until temperatures inside were on some days too high for late morning services. Indeed, the heat and sun together cracked the backs of many of the pews. They were good pews, too, with good material in them.

The Vestry early attempted to meet the problem by cutting the morning services from three to one, which was held at nine o'clock. This wasn't a concession to Sunday golfers or the sleeping habits of the congregation. It was an open-eyed recognition of "ole Sol." But as rector of that parish, I had already recognized him.

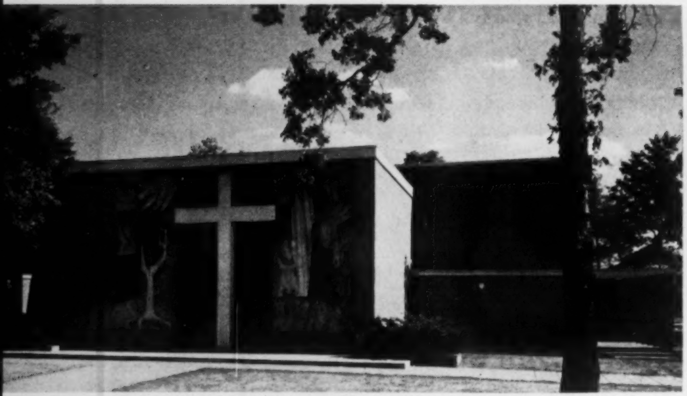
Sunday after Sunday, the shiny starched clerical collar wilted until it collapsed and settled like so many wet coils of rope around my neck. The only solution offered by clerical supply houses was a plastic collar that wouldn't absorb perspiration. A neck wet with sweat and twisting in a plastic collar produces a neck sensation like the feel of raw oysters in the mouth.

Not only that, perspiration running down over my glasses in wide streaks sometimes cut visibility to near zero. The congregation fought the heat by fanning earnestly with cardboard devices supplied by the local undertaking establishment. Some of the congregation twisted continuously, knowing that if they didn't keep moving, they'd probably find themselves stuck, bib and tucker, to the seats.

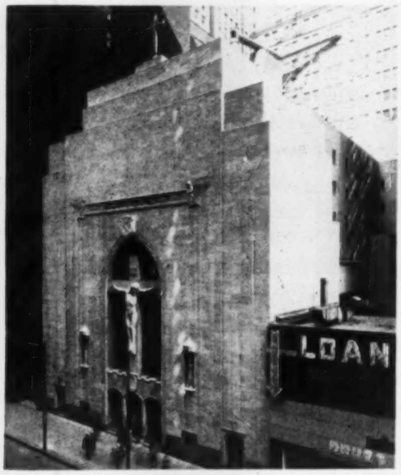
Members in the choir stalls, pocketed in the windowless chancel, were without any relief at all. We tried to remedy this by small electric fans, which junior members thoroughly enjoyed by tearing pieces of paper to confetti size and sending them on fan breezes happily upward to the ceiling of the church.

The candles on the altar were even more of a problem. Few, if any, of even the most expensive candles will withstand intense summer heat without drooping. At the end of a summer Sunday morning service, the candles across the altar were burning at a dozen angles. On occasion, we had to put one out for safety's sake. We hit upon the idea of removing the candles from the altar during the week, but the temperatures followed us on into the sacristy where, even though laid down, they still bent in gentle curves.

In my church, the administration of the Holy Com-



THE CHURCH OF ST. CLEMENT, EPISCOPAL, Alexandria, Va., finds air conditioning a practical solution to the prolonged high temperatures and high humidity in the Washington, D. C. area. Periodic check-ups provided in an annual maintenance contract has kept the system operating trouble-free



ST. PETER'S ROMAN CATHOLIC CHURCH, hemmed in by tall buildings in Chicago's Loop, reports greater staff efficiency the year 'round as a result of air conditioning. Says the pastor, "And it makes church-going attractive"

Is Necessary

"WORSHIPERS who can leave their church to meet other appointments not looking wilted and beaten, will be more likely to attend and contribute in good spirit"

munion is a delicate and aesthetic part of the clergyman's work and his duty to his congregation. However, no minister can maintain the highest level of spiritual impact when he is constantly forced to mop away the perspiration during the service. Also, cleanliness and hygiene are prominent factors for the conscientious parson.

Perspiring brides, pallid grooms, wilted bridal gowns — plus a fainting acolyte or two — add up to a receptive mood for air conditioning.

A make-shift remedy in the form of an exhaust fan poured both hot air and dust over the faithful. A powerful monster, it sucked in air through every tiny crack in the church. At top speed, the old church wheezed around window casings and under doors until, finally, an usher would open more windows and doors so that the church could settle back on her foundations.

This thoughtful move by the usher was usually accompanied by series of flying church bulletins and riffling of hymn book pages. As this normally took place at the beginning of the sermon, no one knew the text that the parson had selected.

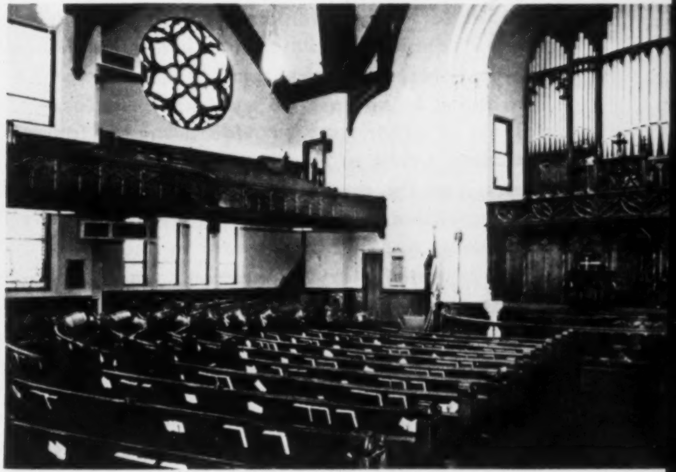
As long as we kept that exhaust fan, weddings were sheer delights. It was always uncertain whether the bride would be able to keep up with her gown on her march to the altar. It was frequently a huge billow rolling ahead of her rather than a sedate train following behind. There was no fainting, however.

Actually, the exhaust fan did provide a noisy reminder for everyone that some type of year 'round air conditioning was needed. A good exhaust fan, properly installed, may be a boon indeed, even though, on occasion, such an installation may waft in delectable odors from a kitchen next door that is alive with luncheon preparations.

Certainly, some type of air conditioning for our churches is becoming increasingly necessary. Outside noise and movement are on the increase, either of which may be a distraction impossible to cope with. Hence, the only satisfactory solution must permit the windows to remain closed at all times. In some localities, the problem of outside interference has become so acute that churches are being built without windows.

The day is past when the church structure can be deserted in hot weather in favor of a gathering under the trees. Rightly or wrongly, for many church attenders the Sunday Service merely makes a part of the crowded day. If worshipers can leave their church to meet other appointments not looking wilted and beaten, they'll be more likely to attend — and contribute — in good spirit, it seems to me.

CHURCH OF THE NAZARENE, Bethany, Okla., like hundreds of other churches, finds air conditioning a requirement for year 'round comfort. After air conditioning was installed, summer attendance increased, as did participation in other church activities



FOURTH AVENUE METHODIST CHURCH, Louisville, is air conditioned with four package units. Supply air ducts are installed at the sides, since the church has a high arched ceiling. Return air intakes are on the units, two of which are installed in the basement and two in the vestibule

Consider Pump Heads For

Adequately Sizing Expansion

● Any analysis of a hot water heating system that does not take into account the effect of the pump head is inadequate for properly sizing the expansion tank, the authors point out. Given here is a method to insure an adequately sized tank by determining the effects on pressure by pumps, height of the system, and friction loss.

By Ray C. Chewning and Robert W. Peterson

J. Donald Kroeker and Associates
Professional Engineers

Data for the proper sizing of expansion tanks cannot be found in existing handbooks, reference books, and manufacturers' literature. In no case do existing formulas, tables, or other data provide a means for including pump effects in sizing expansion tanks. Yet, the errors caused by such a lack are expensive to everyone, namely, owners, designers, and manufacturers, in terms of money, satisfactory operation, and the maintenance and repair of equipment.

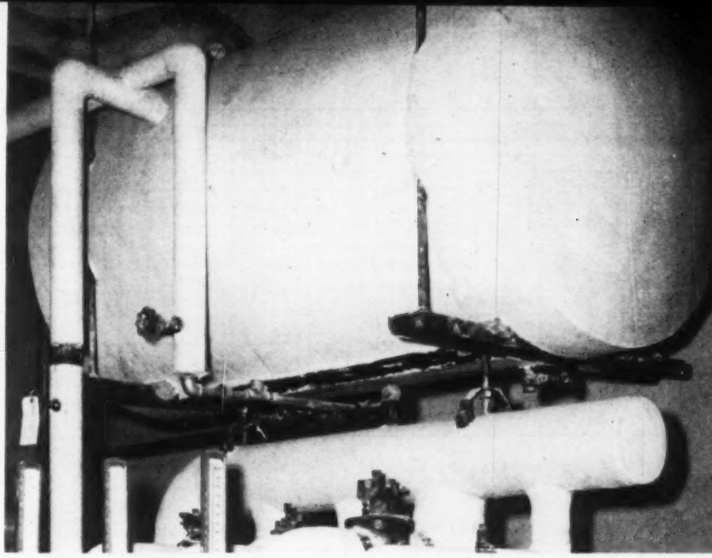
The basic principles involved in proper sizing of tanks are simple. *The pressure in the expansion tank remains the same whether the system pump is in operation or not.* This is true because pump operation does not change the volume of air or the volume of the water in the system. Since the volume of the air remains the same, the pressure remains the same.

The pressure in the expansion tank is not affected by pump operation. The pressure at any point in a closed hot water heating system is the algebraic sum of the pressure effects of pumps, height of system, and pressure loss due to friction.

The procedures and formulas developed herein are presented as simplified, practical methods of determining these pressures for adequate sizing of expansion tanks.

No recommendation to install the circulating pump in any particular location is made in this article. Location of both the boiler and the expansion tank on the suction side of the pump results in a minimum size expansion tank. However, convenience of piping arrangement for zoning and for adjustment of flow according to temperature drop make the decision regarding pump location a consideration for each particular job.

Tanks



Expansion tanks for hot water heating installations during the last 10 years frequently have proven too small to absorb the thermal expansion of the water in the system. In nearly all cases, these installations are in medium sized buildings — such as schools or office buildings, two or three stories high — with 30 psi hot water boilers used as the sources of heat. The calculated heat losses range from 800 to 2000 Mbh; pump heads vary from 15 to 30 ft.

This lack of capacity in the expansion tank has finally been traced to the effect of pump head. This effect depends upon the location of the pump in the system, with respect to the boiler and the expansion tank. Since no handbook has been found to evaluate these factors adequately, it is necessary to return to fundamentals.

What is an Expansion Tank?

The expansion tank is a vessel containing air or other gas, connected to a hot water heating system to absorb the change in water volume due to thermal expansion and contraction. If no expansion tank were provided for a system, a slight increase of the average water temperature would result in an increase of pressure so that the relief valve, required on all boilers by the American Society of Mechanical Engineers Boiler Code, would open and waste some of the water. When the water cooled, the system would no longer be full unless more water was introduced. Each time new water is fed into the system, it contains air, which can cause corrosion or form air locks which reduce circulation. Also, chemicals introduced with the water cause corrosion and deposits in the system, primarily in the boiler. Further, frequent operation of the relief valve may result in early valve failure.

The size or adequacy of the expansion tank is determined by the degree of temperature change which can be experienced in the system without causing a cycle of water feed and relief. General practice is to size the expansion tank to absorb the thermal expansion of the water in the system for the temperature change from the minimum system filling temperature, generally 40 F, to the maximum average operating temperature, generally 200 F. The percentage expansion of water when heated from 40 F to temperatures commonly found in hot water heating systems is shown in Fig. 1.

Deriving Tank Sizing Equation

The operation of an expansion tank is based on a principle of physics, expressed by Boyle's law, which states that the volume of a gas is inversely proportional to the absolute pressure exerted on it. The tank with volume V is filled with air, usually at atmospheric pressure, 14.7 psia, designated as P_i, initial pressure. Then the system is filled with water. The increase in pressure on the tank is equal to the height, H, of water in the system. One foot of water at 40 F is equal to 0.434 psi. Ignoring pump effects, the "fill" pressure of the tank, is $P_i + 0.434H$ psia. The volume occupied by the air in the tank decreases as the system fills; the pressure increases as water enters the tank. According to Boyle's law, the volume of the air under these conditions is:

$$V_a = VP_i/P_i + 0.434H \quad \ldots\ldots[1]$$

Ignoring pump effects, the maximum pressure allowable in the expansion tank is the setting on the boiler relief valve, P_m. Again, with higher system pressure, more water enters the tank and the volume occupied by the air is:

$$V_a = VP_i/P_m \quad \ldots\ldots\ldots\ldots\ldots\ldots[2]$$

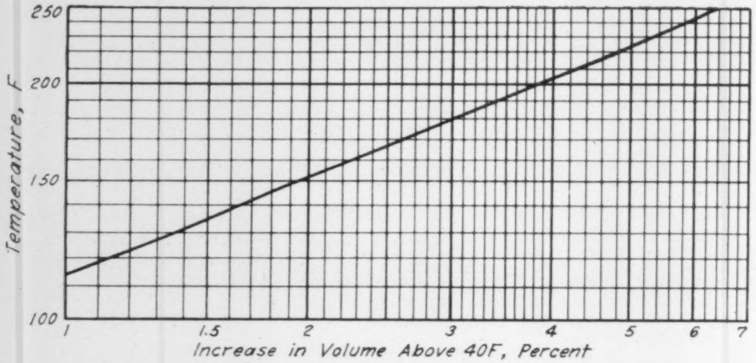
The volume of the expansion tank which is effective in absorbing the thermal expansion, E, of the water in the heating system is the difference in volume occupied by the air in the tank during fill conditions and the conditions of maximum pressure allowable in the tank. That is:

$$E = VP_i/(P_i + 0.434H) - (VP_i/P_m) \quad \ldots\ldots\ldots\ldots\ldots[3]$$

Solving this equation for V,

$$V = E/[P_i/(P_i + 0.434H) - P_i/P_m] \quad \ldots\ldots\ldots\ldots\ldots[4]$$

This is the form of equation in the American Society of Heating and Air-Conditioning Engineers Guide. The weakness of this formula is the fact that it ignores the effect of pump head in establishing pressure effects on the fill or cold volume of air in the expansion tank and on the volume



1 DETERMINATION OF THE THERMAL EXPANSION of the water for the temperature change possible in the system is an integral step in properly sizing an expansion tank. For example, the water volume expands 2 percent if the temperature rises to 150 F from a base of 40 F

under conditions of the maximum pressure allowable.

Here's A Typical Case

To illustrate the effect of pump location on expansion tank sizing and the short comings of present tank sizing methods, several boiler room arrangements are analyzed in Figs. 3 through 7, for an otherwise identical hot water heating system. The building served is a three story building with the boiler room in the basement. The difference in elevation from the high point of the system to the relief valve on the boiler is 27 ft. The heat loss of the building is assumed to be 833 Mbh. The boiler has a rating of 1020 Mbh by the Steel Boiler Institute standards and is a 30 psi hot water boiler. To simplify calculations, the closed expansion tank and the pump are at the same elevation as the boiler relief valve. The system is provided with an automatic water feeder to maintain atmospheric pressure as the minimum at the highest point in the system to assure elimination of air at the point at all times. Thus 27 ft can be considered as the height of the system. The circulating pump has a capacity of 85 gpm at 20 ft head.

How It's Done Now

A common arrangement for piping and equipment is shown in Fig. 1. To determine the size of the expansion tank according to the ASHAE

Here's Method for Sizing Tank

The sizing of an expansion tank cannot be accomplished adequately by the use of rule of thumb methods. The variations in tank size for the same heating system with different boiler room piping arrangements calculated in this article prove this statement,

The proper sizing of an expansion tank can be accomplished by the use of the procedure outlined below.

1) Determine the volume of water in the system.

2) Determine the thermal expansion of the water, E, for the temperature change possible in the system. See Fig. 1.

3) Make a rough diagram of the system showing:

a) The respective location of the boiler relief valve, the pump, the expansion tank, and the expansion tank connection.

b) The height of the system.

c) The pump head.

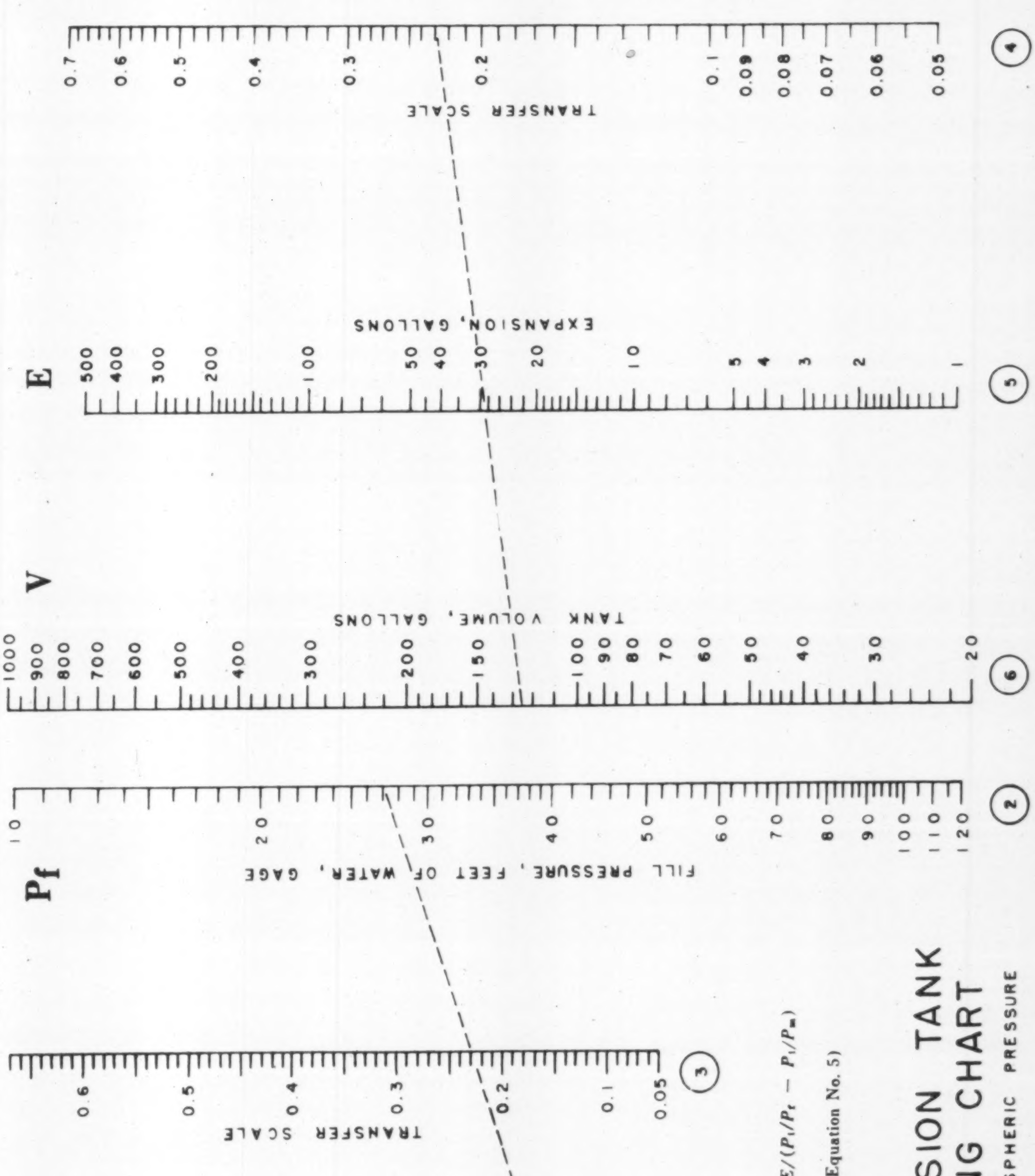
d) The boiler relief valve setting.

4) Determine the pressure at various critical points in the system for the minimum and maximum operating conditions to be encountered. The most commonly encountered piping arrangements are diagramed in Fig. 8, and their effects upon expansion tank size are summarized. Actually, the effect of still different arrangements or operating conditions could be illustrated, for example, the location of the expansion tank in a place other than the boiler room. The necessity of determining the effects of pressure loss due to pipe friction for a remote tank location and connection would complicate this article beyond desired limits. In any case, if pressures P_i, P_f, and P_m are determined strictly according to definition, the proper tank size can be calculated by the use of Equation No. 5:

$$V = E/(P_i/P_f - P_i/P_m) \quad \ldots\ldots\ldots\ldots [5]$$

Use Chart To Find Tank Size

An alignment chart has been developed to aid in the solution of Equation No. 5 and is shown in Fig. 2. The chart applies only to problems where P_i is equal to atmospheric pressure. The scales for P_f, and P_m, are graduated and marked for pressures in feet of water gage to reduce the amount of calculation to a minimum. Although shown on the chart, the equation may be used only if P_i, P_f, and P_m are expressed as absolute pressures. To use the chart in determining the volume of the expansion tank, the values for E, the system expansion P_f, the tank fill pressure; and P_m, the maximum tank pressure, are calculated in terms of gallons and gage pressure, respectively. A straight edge is laid on the chart across lines 1, 2, and 3, so that P_f and P_m may be read at the intersection of the straight edge with their respective scales. The value on scale three is noted and marked on scale 4. The straight edge is then shifted to cover scales 4, 5, and 6 so that it intersects scale 4 at the noted value and scale 5 at the value for expansion. The volume required in the expansion tank may then be read on scale 6 at the intersection of the scale and the straight edge.



2 TO OBTAIN THE VOLUME of a correctly sized expansion tank, line up Scales 1 and 2 to find point on Scale 3; transfer this value to Scale 4 and line up with value on Scale 5 to obtain tank volume on Scale 6

Guide, the following procedure is used:

1) Determine the water content of the system in gallons:

Boiler, from manufacturer's data	275
Radiation, finned pipe	70
Piping	380
Total water in system, gal	725

2) Determine the amount of expansion, assuming 40 F fill temperature and 200 F average flow temperature:

The expansion is 0.04 × system volume:

0.04 × 725 = 29 gal of expansion.

3) Determine V, size of tank, from the equation in the Guide:

$$V = E/[P_1/(P_1 + 0.434H) - P_1/P_m] \qquad [4]$$

where P_1, atmospheric pressure, = 14.7 psia; P_m, maximum system pressure, = 30 + 14.7, or 44.7 psia; H, height of system, = 27 ft (therefore $P_1 + 0.434H$ = 14.7 + 11.7, or 26.4 psia); and E, expansion, gal, = 29.

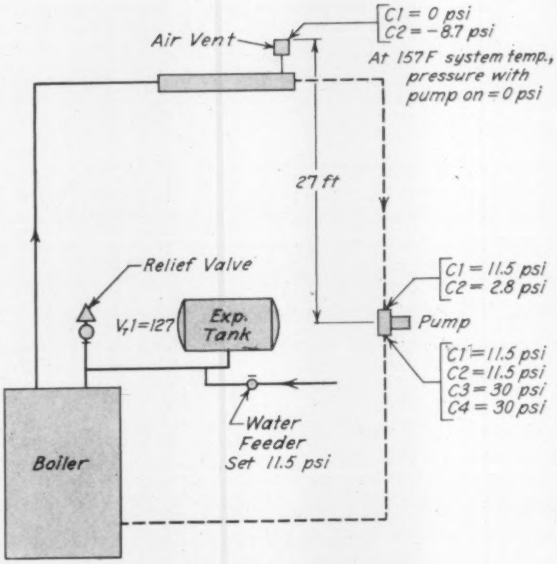
$$V = 29/(14.7/26.4) - 14.7/44.7)$$
$$= 126 \text{ gal}$$

In this discussion, all pressures are expressed as feet of water with 1 ft of water equal to 0.434 psi, and atmospheric pressure equal to 34 ft of water.

In order to understand the difficulties caused by the above method of expansion tank sizing, it is necessary to analyze the hydraulics of the hot water heating system a little more thoroughly. Fig. 4 is exactly the same as Fig. 3 except that an open expansion tank is installed at a height to obtain the same pressure on the boiler when the system is filled as obtained with the closed expansion tank.

It is apparent that the pressure at the relief valve and expansion tank connection is 27 ft of water or, more simply, 27 ft. Assuming that the piping between the pump and boiler is short and amply sized, the pressure at the discharge of the pump is 27 ft. Since the pump generates a head of 20 ft, the pressure at the suction of the pump is 27 minus 20, or 7 ft. Again ignoring pressure loss due to friction, which would be very small if the length of pipe is short, the pressure at the air vent valves on the radiation close to the pump suction

expansion tank size depends on



3 A COMMON ARRANGEMENT of pump and piping for a hot water heating system with boiler in basement is shown here. Thermal expansion in system will increase pressure until it is zero psig at the high point with 157 F average water

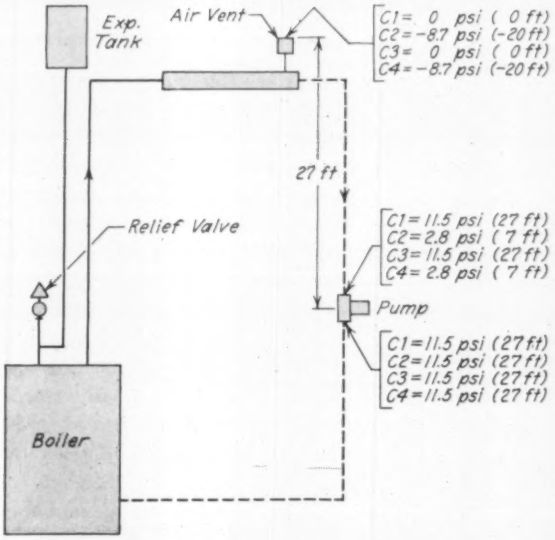
LEGEND

Figs. 3, 4, 5, 6, and 7

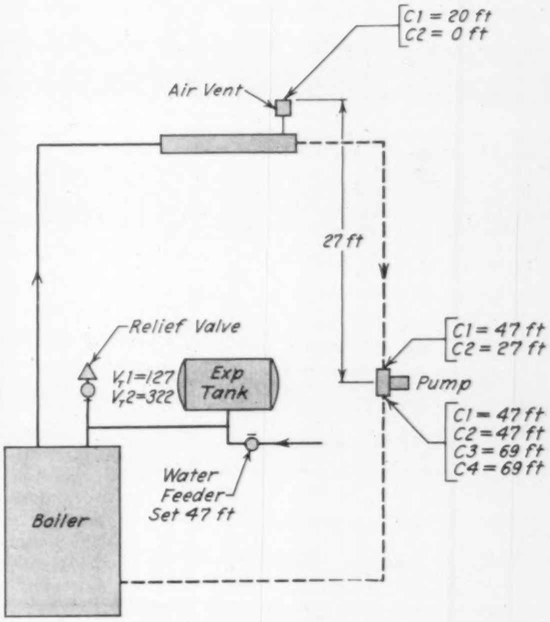
Gage pressures at points in the systems where shown are for system characteristics as follows:

C1 System at 40 F and pump off
C2 System at 40 F and pump on
C3 System at 200 F and pump off
C4 System at 200 F and pump on
V_t1 Expansion tank volume, gal, Equation No. 4
V_t2 Expansion tank volume, gal, Equation No. 5
Add 14.7 psi to obtain psia
Add 34 ft to obtain ft absolute
Relief valve set at 30 psi = 69 ft
Pump head = 20 ft
Expansion tank is open type for Fig. 4, closed type for all others

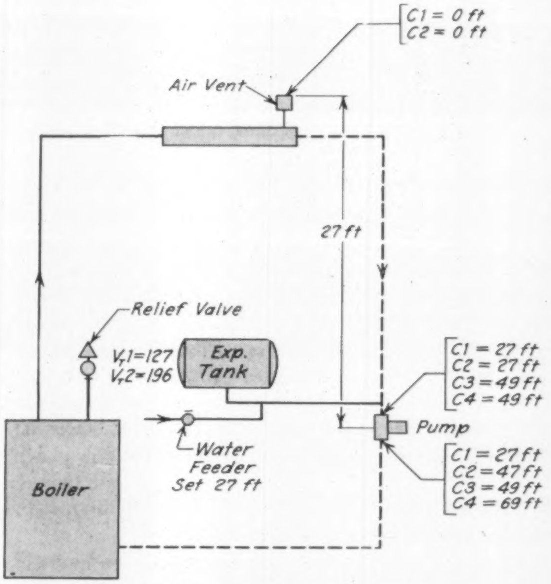
the piping system and its operating characteristics


Exp. Tank
Air Vent
C1= 0 psi (0 ft)
C2= -8.7 psi (-20 ft)
C3= 0 psi (0 ft)
C4= -8.7 psi (-20 ft)
27 ft
Relief Valve
C1= 11.5 psi (27 ft)
C2= 2.8 psi (7 ft)
C3= 11.5 psi (27 ft)
C4= 2.8 psi (7 ft)
Pump
C1= 11.5 psi (27 ft)
C2= 11.5 psi (27 ft)
C3= 11.5 psi (27 ft)
C4= 11.5 psi (27 ft)
Boiler

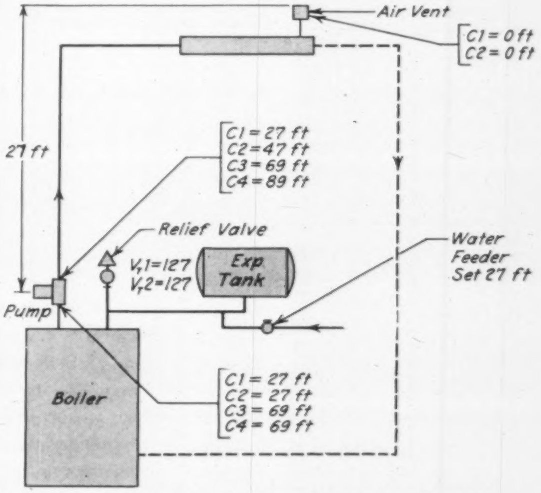
4 AN OPEN EXPANSION TANK is installed here at a height to obtain the same pressure on the boiler when the system is filled as obtained with the closed expansion tank shown in Fig. 3. Negative pressure develops when pump is operating


C1 = 20 ft
C2 = 0 ft
Air Vent
27 ft
Relief Valve
$V_t1=127$
$V_t2=322$
Exp Tank
C1 = 47 ft
C2 = 27 ft
Pump
C1 = 47 ft
C2 = 47 ft
C3 = 69 ft
C4 = 69 ft
Water Feeder Set 47 ft
Boiler

5 RAISING THE FILL OR MINIMUM PRESSURE at which a system with a closed expansion tank operates — by an amount equal to the head of the pump — necessitates recalculation of the size of the tank


C1 = 0 ft
C2 = 0 ft
Air Vent
27 ft
Relief Valve
$V_t1=127$
$V_t2=196$
Exp. Tank
C1 = 27 ft
C2 = 27 ft
C3 = 49 ft
C4 = 49 ft
Pump
Water Feeder Set 27 ft
C1 = 27 ft
C2 = 47 ft
C3 = 49 ft
C4 = 69 ft
Boiler

6 A SECOND PIPING ARRANGEMENT — with the circulating pump between the expansion tank connection and the boiler — results in a smaller tank — 196 gal — than that for the arrangement in Fig. 5 — 322 gal


Air Vent
C1 = 0 ft
C2 = 0 ft
27 ft
C1 = 27 ft
C2 = 47 ft
C3 = 69 ft
C4 = 89 ft
Relief Valve
$V_t1=127$
$V_t2=127$
Exp Tank
Water Feeder Set 27 ft
Pump
C1 = 27 ft
C2 = 27 ft
C3 = 69 ft
C4 = 69 ft
Boiler

7 A THIRD BASIC PIPING ARRANGEMENT — the exception rather than the rule — uses a smaller expansion tank than the other two. The pump does not affect the limiting pressures at either the boiler relief valve or the expansion tank on the second and third floors would be less than atmospheric. Under these conditions, air could not be eliminated from the air vent valves whenever the pump was in operation. Eventually, air blocks would develop and difficulties in heating would occur. Exactly the same situation would develop with a system whose minimum pressure and tank size was determined as discussed on the basis of Fig. 3. With an open tank, negative pressure would develop whenever the pump was in operation. With a closed expansion tank, thermal expansion in the system would increase the pressure until it would be zero psig at the high point with an average water temperature of 157 F.

The situation can be corrected in a system with a closed expansion tank by raising the fill or minimum pressure at which the system operates, as shown in Fig. 5. The system pressure should be increased by an amount equal to the head of the pump. The increased system pressure affects the expansion tank characteristics, so that the size of the tank must be recalculated.

Re-define Tank Equation Terms

The equation is derived in the same manner as is Equation No. 4. The difference lies in the designation of the pressures involved, and in the procedure for determining those pressures.

Equation No. 4 becomes

$$V = E/(P_i/P_t - P_i/P_m) \quad \ldots .[5]$$

where P_i = the initial pressure of the air in the expansion tank before the system is filled with water, as before; and P_t = the pressure necessary in the tank to maintain pressure at the highest point in the system at all water temperature and operating conditions (the effect of pump head or pressure can be included in this term, whereas it cannot be included in $P_i + 0.434H$); and P_m = the maximum pressure permissible in the expansion tank (again, the effect of the pump can be included).

How To Use Suggested Equation

It is possible to prevent a pressure less than atmospheric from existing in any part of the system, as discussed with regard to the open expansion tank in Fig. 4, by installation of a closed expansion tank and calculation of the proper minimum pressure to be maintained in the tank. The solution of the problem is illustrated in Fig. 5. With this piping arrangement the maximum pressure required to maintain a positive pressure throughout the system when the water is at 40 F occurs when the pump is in operation.

How Inadequate Tanks "Get By"

Why hasn't trouble developed with more expansion tanks if methods of calculation are so inadequate? A number of reasons can be listed.

1) It is very seldom that the average water temperature of a system drops below 70 to 80 F after the system has been placed in operation. This would allow a reduction in the size of the tank of 5 to 6 percent.

2) Some systems maintain a "hot" boiler 24 hours a day after the heating season starts. Since the boiler represents approximately 35 percent of the water volume of many systems, and this water volume would be at a practically constant temperature, the volume of the expansion tank could be reduced by approximately 30 percent for such systems.

3) Some systems designed to operate at an average water temperature of 200 F operate at a maximum average water temperature of approximately 170 F. Such systems would require approximately 30 percent less volume in the expansion tank.

4) Where a system operates 24 hours per day, every day, the expansion tank size could be 50 percent of the size calculated.

5) Where an expansion tank is drained through the boiler, if the boiler discharge valve remains closed until much of the air in the boiler is compressed into the tank, P_i of Equation No. 5 will be considerably in excess of 34 ft absolute, and the size of the expansion tank required for such a system will be considerably less than calculated with P_i equal to 34 ft absolute. It is very difficult to determine a value for P_i in such a system during design.

6) Just as the water expands when it gets hot, so does the radiation, the piping, and the boiler in which the water is contained. The effect is such as to allow a reduction in expansion tank volume of 5 to 10 percent.

7) In some cases where a considerable volume of air is trapped in parts of the system other than the expansion tank, such as the top of the boiler, cast iron radiation, or abandoned and capped risers, the expansion volume required in the expansion tank is reduced.

8) Last, but more common than is realized, the system may be operating poorly and the trouble blamed on "air problems." Actually, an inadequate expansion tank with daily cycles of feed and relief introducing new air into the system may be the real source of trouble.

These are some of the factors which result in lower volume requirements for expansion tanks. Generally it is inadvisable to anticipate their effect during design. The cost of the expansion tank is usually an exceedingly small part of the cost of a hot water heating system. It is better to pay a few dollars more for an adequately sized expansion tank than to gamble on operating conditions which probably will not occur after the installation is made. Further, since it is generally recognized that expansion tanks do lose their air cushions due to absorption and gravity flow of water between the tank and the boiler, it is recommended that even the possible 5 to 10 percent reduction in tank size due to the expansion of the metal in the system be ignored.

In cases where pressure limits due to building height or pump head are critical, it is recommended that a boiler pressure higher than 30 psi be used, or that a steam boiler with a hot water converter be considered.

If the high point of the system is to be maintained at atmospheric pressure, the pressure at the suction of the pump, 27 ft below that point, must be 27 ft gage. The pump generates a 20 ft pressure; so, the pressure at the discharge of the pump must be 20 ft plus 27 ft, or 47 ft. For use in Equation No. 5 as P_f, this is converted to absolute pressure: 47 ft plus 34 ft, or 81 ft absolute. The maximum pressure in the expansion tank for this arrangement is the same as the setting of the relief valve, 30 psig or 69 ft.

As P_m in Equation No. 5, this is 69 ft plus 34 ft, or 103 ft absolute. P_i, the pressure of the air in the tank before the system is filled, is atmospheric, or 34 ft absolute. The thermal expansion in the system is 29 gal, as before. Substituting values in Equation No. 5, the size of the expansion tank is:

$$V = 29/(34/81 - 34/103) = 322 \text{ gal}$$

From these calculations, it is evident that the 126 gal expansion tank first calculated is entirely inadequate, less than 40 percent of the size actually required.

A second piping arrangement that is possible is shown in Fig. 6. In this case, the circulating pump is shown in the piping between the expansion tank connection and the boiler.

The analysis of the system starts at the high point near the suction of the pump. It is necessary that a minimum pressure of zero ft gage be maintained at the high point. Therefore, the pressure at the suction of the pump will be 27 ft gage. The minimum pressure in the expansion tank and set on the water feeder is 27 ft gage, or 27 plus 34, which is 61 ft absolute, corresponding to P_f of Equation No. 5. The pressure at the discharge of the pump will be 27 plus 20 ft, or 47 ft gage.

The pressure at the boiler relief valve will be the same as that at the pump discharge and will always be 20 ft greater than the pressure in the expansion tank when the pump is in operation. The maximum pressure in the system is set by the boiler relief valve, namely 69 ft gage or 103 ft absolute. Since the pressure in the expansion tank is 20 ft less than that at the relief valve, the maximum pressure in the expansion tank, P_m of Equation No. 5, is 103 minus 20 ft, or 83 ft absolute. P_i of Equation No. 5 is 34 ft absolute, as before. The thermal expansion volume of the system is 29 gal, as before. Substituting in Equation No. 5 to determine the volume of the expansion tank required for the piping arrangement shown in Fig. 6, the volume is:

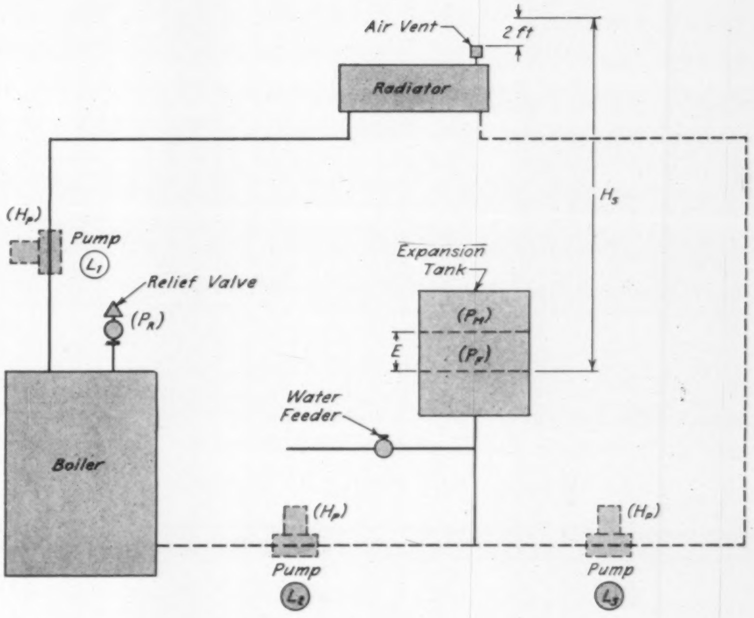
$$V = 29/(34/61 - 34/83) = 196 \text{ gal}$$

While the size of the expansion tank required for the piping arrangement shown in Fig. 6 is considerably less than that shown for Fig. 5, it is still larger than that calculated by Equation No. 4.

A third basic piping arrangement which might be used in the boiler room for the hot water heating system discussed is shown in Fig. 7. It is apparent that the head of the pump does not affect the limiting pressures at either the boiler relief valve or the expansion tank with this arrangement. Again P_i equals 34 ft absolute. Substituting the values shown on Fig. 7 into Equation No. 5, the tank size is:

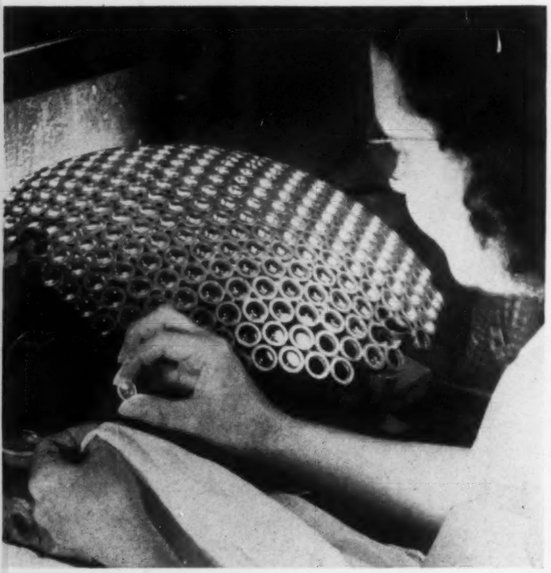
$$V = 29/(34/61 - 34/103) = 126.7 \text{ gal}$$

This tank size is identical, within the limits of slide rule accuracy, with the tank size determined by Equation No. 4. The expansion tank size determined by Equation No. 4 would be adequate for the piping arrangement shown in Fig. 7. Unfortunately, this type of piping arrangement is the exception rather than the rule.



H_s = Height of system above expansion tank
H_p = Head of pump
P_R = Relief valve set pressure
P_M = Maximum pressure in expansion tank
P_F = Water feeder setting
L_1, L_2, L_3 = Various locations for pump
At L_1, $P_F = H_S$, $P_M = P_R$. Results in smallest tank size.
At L_2, $P_F = H_S$, $P_M = P_R - H_P$. Results in medium tank size.
At L_3, $P_F = H_S + H_P$, $P_M = P_R$. Results in largest tank size.

8 THE THREE MOST COMMON PIPING ARRANGEMENTS and their effects on expansion tank size are shown here. After a diagram of the system is drawn, the pressure at various critical points in the system for the minimum and maximum operating conditions should be determined



CONTROLLED temperature and humidity and dust free atmosphere are achieved by two separate central air conditioning systems, several packaged units and electrostatic air filters in the new windowless optical plant of Argus Cameras, Inc.

VACUUM TUBES tipped with paper cones are used to clean lenses during inspection before assembly

Cool, Clean,

By O. G. Hylton

Year 'round cooling and cleaning of air along with rigid control of humidity are provided in the recently completed new optical plant of Argus Cameras, Inc., Ann Arbor, Mich. Its windowless construction and heat producing machines and processes — and the ever present enemy, dust — require the most favorable indoor climate in order to meet the rigid specifications for manufacturing and assembling precision products.

Argus makes and tests several types of precision instruments for the government, including telescopes and fire control devices, in addition to turning out some 70,000 cameras and projectors each month. All have lenses or prisms, and some have both, made from optical glass, ground to individual specifications.

To control temperature, humidity and air motion, and to provide comfortable working conditions for personnel, an extensive air conditioning system is installed. Several independent systems are utilized, including both central station type and packaged equipment.

Lens making by Argus starts in the "blocking room," where glass blanks are attached to steel blocks with pitch. This space is not cooled by refrigeration, but in most cases, induction heating is used in the lens blocking operation to reduce heat given off into the room. An exhaust system is installed in this area to remove the heat and likewise pull in

Dry Air for New Camera Plant

. . . is provided by central systems and packaged units to increase technical efficiency in the production of precision optical devices

spillover air from the rest of the one story windowless building.

Once blocked, lenses go first to the grinding room and then to the polishing room. Both processes are accomplished on a mass production basis in rooms with several rows of motor driven equipment. It is necessary to control the air temperature because grinding and polishing abrasives are held in pitch, which must be kept at the proper degree of hardness. The air temperature in the polishing room is maintained between 80 and 85 F. Two separate air conditioning systems are installed in these rooms, each using a compressor directly driven by a 30 hp 1800 rpm motor. The condensing units, equipped with direct expansion coils, are in the machinery penthouse on the second floor. Air is supplied at the flow rate of 15,000 cfm through ducts suspended from the ceiling.

Diffusers are employed to avoid drafts on lenses, which might affect the condition of the pitch. Controls for these two systems are pneumatic and are designed for sequence operation. Outside air is used for ventilation and for cooling, until the cooling effect is no longer present. Then the controls start the refrigeration cycle. During the summer the systems use 10 percent outside air, but in winter up to 100 percent outside air can be employed if needed.

In the lens coating operation, which follows the polishing process, a coating of magnesium fluoride — to increase the lens speed — is applied under vacuum and heat. Air conditioning is an absolute must here, for much heat is produced.

The tool grinding room is served by a 15 ton packaged unit. In the hand grinding and polishing room, where special lens work is done, a 7½ ton unit is used. Another 7½ ton unit cools the room where lens tools are made, and a third 7½ ton machine serves the precision assembly room. A 5 ton conditioner is installed in the tool inspection room.

Thus the problems of temperature and humidity are solved. The humidity — which must be kept low — is controlled within 5 percent. Air is cleaned by filtering and washing, then dehumidified. Oversize filters are used to insure a high degree of cleanliness. In addition, electrostatic air filters are installed where required.

IN VENTILATED BOOTH a protective coating is sprayed on one side of the lenses before polishing the other side. Oiled paper lining in the booth catches stray particles

PRACTICAL PIPING PROBLEMS

By Bill Dopp

Choosing the Right Material for Piping

. . . is the first fundamental of correct piping design, says Mac when asked by two engineering students to help start their thinking for a thesis on high pressure, high temperature piping. This selection, he says, is determined by six factors: pressure, temperature, physical properties of the fluid or material transported, its chemical characteristics, electrical potential, and the environmental conditions.

"ARE YOU Mr. Martin MacVane?" asked the taller boy at the door.

"Yes."

"I'm Dave Hawley," The young man replied. "This is Jim Drury. My father is chief enginer of the Towner power plant. He suggested that I come and see you."

"Come in," Mac said cordially. "I'm glad to meet you both. Your father, Dave, is an old friend of mine. How is he? I haven't seen him in a long time."

"He's fine. Right on the job every day as usual. He doesn't think of much besides his precious plant. He said to give you his best regards."

"Thanks," Mac replied. "What can I do for you fellows?"

"I'm working on the thesis for my engineering degree. As I get into it, I begin to wonder if I haven't bitten off more than I can chew. The subject is 'High Pressure, High Temperature Power Piping'."

"Whew! You've taken on something there," declared Mac admiringly. He turned to the other fellow. "Jim, are you doing the same?"

"No, Sir. I'm only a Junior, but Dave and I room together. Dave's father suggested the subject, I guess. I came along to lend him moral support."

"What did your father think I could do for you, Dave?"

"He said that you could tell me more about piping in a few minutes than he could in a week. He suggested that I ask you about the best way to handle this subject. Could you give me some hints?" he asked hopefully.

"Wait until I get a card table," suggested Mac as he got up. You'll want to make some notes. Here, have a smoke?" He handed Dave an ornate cigarette box. When they were comfortable, Mac leaned back in his easy chair, put his finger tips together and stared thoughtfully at his young visitors. For a few moments there was complete silence.

Piping Is Transportation

"Let's start at the beginning," proposed Mac. "Then you can use what you want and leave out the rest. First of all you must keep in mind the fact that piping is transportation. Its whole purpose is to transport a fluid or other commodity from one place to another. Like any other transportation, its efficiency must be measured by the unit cost of handling whatever is going through that particular pipeline. It costs money to move steam, or water, or oil, or gas through piping. There are many things that contribute to this cost; among them are the first cost of the line, interest on the investment, and maintenance of the piping system." He paused thoughtfully. "There are certain fundamentals in piping design that must be carefully considered if any piping system is going to be efficient and safe."

"May I interrupt?" asked Dave hesitatingly.

"Surely," consented Mac cheerfully. "Don't hesitate to break in with any question as it occurs to you. That goes for you, too, Jim." He chuckled. "I hope this isn't going to be a lecture. What were you going to ask, Dave?"

"This idea of piping as transporta-

Bill Dopp has had some 40 years of experience dealing with piping, including a long stretch as a sales engineer. He is devoting part of his present leisure to writing of his many piping experiences. All the names used are fictitious.

tion is entirely new to me. I've always thought of it in terms of a structure. You say that we have to determine the unit cost. Just what does that mean?"

Piping System a Structure

"A piping system, when it is complete is a structure," Mac said. "The rules for strength and security that apply to any structure apply to it also. But there are many things that must be considered before we get to the structure stage."

"Where does interest on the investment come in?" asked Jim. "Isn't that part of the general overhead of the plant?"

"Yes it is," agreed Mac. "However, to get at the efficiency of a particular line, you have to break down your costs to the line itself. Suppose you are going to build a steam line that will handle 100,000 pounds of steam per hour, 24 hours a day the year around. Let's say that the first cost of the line is $20,000 and that your plant is based on a 20 year amortization period. At 6 percent that line would cost about $1200 per year." Mac smiled as Jim's eyes opened wide. "That's just the start," he declared. "Let's set the maintenance at 1 percent or $200 per year. To that, you add the general overhead factor, which includes your insurance, taxes etc. But there is another little matter that will need much closer attention."

"What's that?" asked Dave.

"Friction," laughed Mac. "A very costly commodity. It will plague you in every pipeline that you design. Suppose your buildings, boiler cost, upkeep and all, set the cost of steam production at $1000 per lb of pressure drop. If your line has a 50 psi drop due to friction, you will have to capitalize $50,000 for 20 years also."

"That's more than twice the cost of the line," gasped Jim.

"You'll have to capitalize it just the same as you do the cost of your line. It will add a matter of something over $2500 to the cost of transporting your steam each year. You have to take this on the chin, Jim. Without pressure drop, the steam won't move through your line. If you want to get a speed of 10,000 feet per minute, you'll have to have considerable drop." He chuckled. "I said that it cost money to move fluids. See what I mean?"

"Good grief," exclaimed Dave. "The cost is going up fast."

"So far, it's only got to about $0.0000005 per 100,000 pounds. If your maintenance goes to 5 percent instead of 1, or the failure of your line causes a shutdown and loss of production, there's no telling where your cost may go." Mac paused, looking at Dave intently. "Designing high pressure piping is no light undertaking, I assure you."

"Evidently not," said Dave. "But, Mr. MacVane, do you have to go through all of that for every pipe line that you design?"

"No. You can leave much of that to the accountants. The pressure drop you have to watch closely, but if you consider carefully the first fundamental of piping design you won't go wrong on the other things."

"What's that?" the boys asked.

Codes Set Minimums for Piping

"The selection of the proper materials for your line," answered Mac firmly. He got up, went to a book shelf, returning with two small volumes. "These are the foundation stones of all properly designed piping. The Code for Pressure Piping and The American Society of Mechanical Engineers Boiler Code set the minimum qualifications for the strength and safety of piping. They dictate what is currently good practice." He weighed the books in his hand. "When you're designing piping, don't let these books be beyond arm's reach. They are your guide."

"The Boiler Code is principally concerned with boilers, isn't it?" asked Jim.

"Yes," replied Mac. "It also establishes the rules for all the piping connected to the boiler. In some cases, such as the boiler feed, it goes quite a distance from the boiler itself."

"I can see where selecting the right material is important in a high pressure steam line, but does that apply to common piping also?" Dave picked up the Piping Code as he asked the question.

How To Select Piping Material

"Fellows," warned Mac emphatically, "get it fixed in your minds that there is no such thing as common piping. Any pipe that is worth putting up is worth putting up right. Any other way may be dangerous and also very costly. Whether it is in the basement of your home, a steam line, or a lawn sprinkler, if it fails it can easily become the basis of a costly law suit." He was suddenly in a very serious mood. "Let's go back to this matter of selecting material for our line. The first thing we must know is all about the material or the fluid that we are going to transport." He picked up a pencil, writing the words as he spoke them: "pressure, temperature, physical properties, chemical characteristics, and electrical potential, if any."

"The first two are easy," said Dave, "but what about the rest?"

"Not so easy," cautioned Mac. "We must know that both the pressure and temperature are going to be constant, or what the changes will be, and how often they will occur. Your steam line may have 1500 psi and 1000 degrees F at one time and no pressure, and 70 F a few hours later. You have to take both conditions into consideration in everything you do with that line."

"By physical properties, you mean is it water, or steam, or what, don't you?" Jim's eyes were flashing between the paper and Mac's face. "It's going to make a lot of difference what you carry in that line," he declared.

Analyze Properties Carefully

"You're right Jim," assented Mac. "Physical properties can be very different. You may be transporting coal, wood chips, beer, sulpuric acid or steam as well as water. Each requires that we know all about it, or we may get into trouble. For instance, water is not just H_2O. In its pure state, it is very hard to handle and can give you no end of trouble.

"You mean, water is not just

". . . Some pipes get pretty heavy — That makes quite a problem taking care of the expansion."

water," observed Dave, grinning.

"Precisely," laughed Mac. "Some years ago, an eastern city changed its water supply. Within a year, water piping all over town was being replaced. Leaking pipes ruined thousands of dollars worth of decorating, flooded hotel rooms, and generally made life miserable for everyone. Eventually, practically all the water supply piping in town had to be replaced."

"What happened to the water?" asked Jim, frowning.

"The new supply came from the mountains with a timbered watershed," said Mac. "It had a lower mineral content than the old supply, but it also had a considerably lower pH than the other. Water coming from timbered country has a tendency to pick up certain acids. You will find nothing more destructive of water piping than weak acid."

"I suppose they put in copper pipe," suggested Dave.

"Yes, Dave," affirmed Mac. "They had to use copper fittings and brass valves, too, since widely dissimilar metals in a line will frequently set up another kind of trouble. When metals having different electrical potentials are used in the presence of any fluid which can act as an electrolyte, galvanic action will begin and galvanic corrosion will destroy one or the other of the metals, ultimately causing the line to fail."

"Gee," exclaimed Jim. "What about your steam line, Dave? If a water pipe can get as complicated as that, a high pressure steam line must be a dilly."

Temperature Decides Material

"The ultimate maximum temperature is going to be the deciding factor in selecting the material for your line, Dave," declared Mac. "If you're going to play around the thousand degree mark, maybe up to ten fifty, you will have to choose one of the newer chrome alloy steels, probably 2 or 2¼ percent chrome and 1 percent moly. Stabilization against graphitization and a low creep rate are essentials, but you have to keep other things in mind. Pipe joints, for instance."

"The joints will have to be welded of course," asserted Dave casually.

"Of course. But let's think of the pipe, first. Your steel will have an allowable stress of about 12,000 psi at 70 degrees. At 1050 F it will be only 4800 psi, or about 40 percent of the allowable cold stress. It is on this basis that you will determine the P/S or pressure stress relationship and the thickness of the pipe."

"They have recently changed the P/S formula for high pressure piping," said Jim. "We were discussing that in class the other day. How can they do that? If the other formula was right, and a lot of piping was designed with it, why change it?"

"Because the original formula did not contemplate the high temperatures that are in use today. And the result of experience and research has shown that with the new metals there is no need to make piping quite as heavy as would result from using the original formula.

"Some of these pipes get pretty heavy," commented Dave. "In one station I know of, the steam piping is 17½ inches OD and over 3 inches thick. That makes quite a problem of taking care of the expansion."

"Why Weld the Pipe Line?"

"We'll get to the matter of flexibility later in our discussion," said Mac. "Right now, we're interested in the quality and strength of the material that we're going to use. You said that, of course, you would weld the line, Dave. Why?"

"Well, . . ." hesitated Dave. "That's the accepted practice. As you said about the pipe thickness, the new technique in welding has developed from the research that has been going on in the welding field for years. I don't know how else you would make the joints. You certainly couldn't bolt them. They had to go to pressure-seal bonnets on valves to keep them from leaking." He paused, shrugging his shoulders. "Sure, you'd have to weld them."

"Suppose the turbine manufacturer isn't very receptive to the idea of your welding your line to his turbine. Then what?" Mac asked.

"I know," snapped Jim. "There is a type of line joint like a pressure-seal bonnet joint that has been used. If I remember right, they use two different metals for it, too."

"Right you are, Jim," laughed Mac. "Dave is right, too. The line joints will undoubtedly have to be welded, but the turbine end of the line may need some such joint as you suggest." He turned to Dave. "You see that they used different metals in the joint. Selection of material again, to meet specific needs. It's always the first fundamental." He paused to let that sink in. "In this case, it has been the temperature that has decided what we would do. In the case of water, it might be corrosion. But in the case of a food processing line, it might well be the matter of contamination of the fluid which would determine the answer."

"In low pressure lines, wouldn't the kind of joint have something to do with the selection?" asked Dave.

"It might have some influence," Mac said. "For instance, in a plant where, because of volatile fumes, welding would be ruled out. Generally speaking, you can adapt almost any kind of mechanical pipe joint to all the materials you are likely to use. A flange can be put on a tubular product with threads, by lapping, or even by shop welding, so that the choice there is a wide one." He paused gravely. "In fact, Dave, you might not be able to get some of the highly refined new alloy steels for your steam line, because the welding procedure for that particular metal has not yet been worked out."

"Then it is the five characteristics of the fluid carried that determine the material for the piping?" summarized Jim.

Consider External Conditions

"That is true," asserted Mac, "except when you have external conditions that could seriously damage the kind of material that you have in mind."

"Like what?" interrupted Dave.

"Sometimes," said Mac, "you have very corrosive conditions outside of the pipe, such as acid bearing soil or contaminated atmosphere that carries a fairly heavy sulphur content. Then the outside conditions might be the real determining factors for your selection."

Mac took the pencil, writing another word at the end of his brief list. "We better add environment to this list. It can play an important part, especially in mine work or in the processing industries. A bunch of us once got a surprise when a downspout on a paper mill proved to be nothing but a shell of several coats of paint. The pipe had been completely destoyed inside this shell by the sulphur fumes from the mill that had been picked up by the rain water." He laughed aloud at a new thought. "Even water from the sky may not be just H_2O."

The boys laughed with him. "Gosh, you get all kinds of surprises when you get to talking about these things," said Jim. "I wish that some of the other fellows could have been in on this."

Choose the Right Valves

"So far we have talked about only a part of your line, Dave," Mac pointed out. "What about valves?"

"When we determine the kind of material in the line, that settles the valves, too, doesn't it?" contended Dave.

"I was thinking the same thing, but your question makes me think there is a catch in the valve matter," hedged Jim, looking doubtfully at Dave.

"In our high pressure steam line, we would use pressure-seal valves," argued Mac. If you examine those valves closely, you'll find that they contain about 15 different kinds of metal. During the war the Navy had a valve with 22 different metals. That may seem silly, but there was a good reason for every one of them." He paused, smiling at the look of astonishment that met his statement. "Now, in our valves there will be about six of these metals actually in contact with the steam. We can start with one metal for the body. It should be of the same material as the pipe. Don't you think so?"

"Yes," admitted Dave, "except that it would be cast material instead of forged." He hesitated, then declared, "I think I'd let the valve manufacturer worry about the rest of it."

Jim chuckled, "I don't think that Mr. MacVane will agree with that idea."

"You're right, Jim," affirmed Mac. "No, Dave, it's your responsibility. The man who designs the valves puts all of his knowledge and experience into them and does his best to give you the finest product for your needs that he can. But other manufacturers may not agree with him. It's up to you to choose between them."

Chagrined, Dave said, "I really stuck my neck out that time." They laughed together over his discomfiture.

"That's the way we learn, Dave," consoled Mac. "You'll have to know why the valve designer chose to use every one of those metals. Why use a different metal for the seating surfaces than for the disc, and still another for the stem? Is his reason for choosing a softer metal for the seal ring valid? You'd better know." He put a sharp emphasis on his injunction.

"Come to think of it, the whole inside of the valve is really a part of the line," ventured Jim. "I can see now that it does make a difference what goes into a valve."

"You don't buy valves by the appearance of the package the way you do cereal at the supermarket," laughed Mac. "I don't mean that it's up to you to design the valves. That's really someone else's business, but you do have to know what he's doing, and why."

"I suppose the same thing applies to the valves in any line," decided Dave.

"You bet it does," emphatically agreed Mac. "The failure of a small brass valve that has been put into a line with too much pressure for it may cause a lot of damage, or even a life." Mac glanced at his watch. "It's getting late, fellows, so I guess we'd better sum this up for the time being. We can take up the other fundamentals at a later date." The boys started to rise, but Mac held up his hand. "Just a minute," he cautioned. "Let's see what we have accomplished. Dave, what's the first fundamental of piping design?"

Review First Fundamental

"The selection of the material for the line," he answered, smiling broadly. "I will never forget that, I'm sure."

"All right. Jim, on what must the selection be based?" Mac asked.

"The pressure, temperature, physical properties, chemical characteristics and electrical potential," replied Jim promptly. "And environment!"

"Then you have to know all about the materials you intend to use," interjected, Dave heartily.

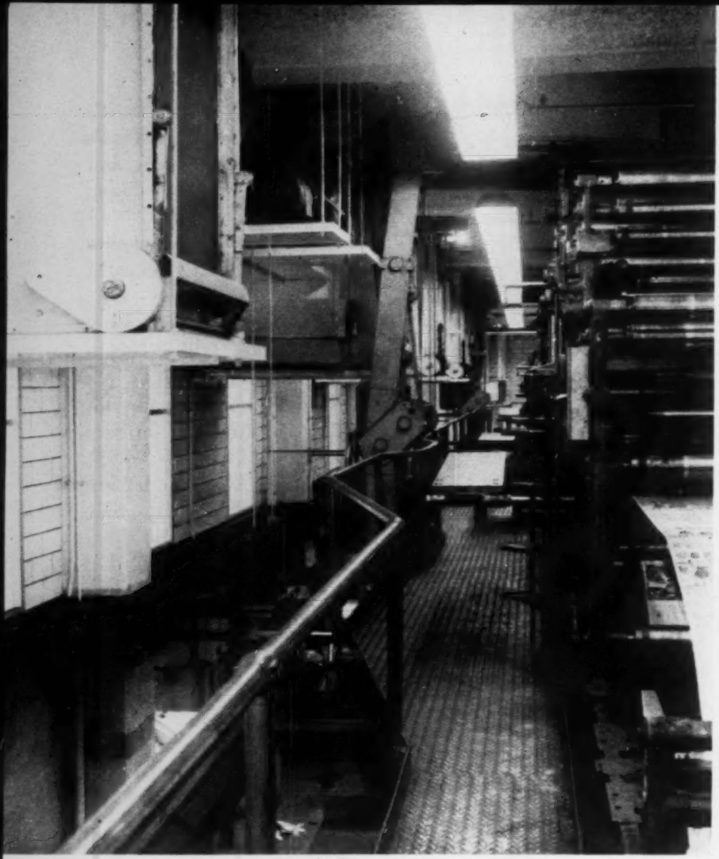
"And don't forget the Codes," laughed Jim, beating Mac to the question.

"What does the selection of the material mean to the plant accounting department?" asked Mac.

"It determines the first cost and the interest charges," declared Dave. "I think it will also determine the maintenance cost. The nearer right the selection is, the less chance that there will be any trouble with the line."

"Then there is that little matter of pressure drop, the costly commodity," joked Jim. "We didn't get very far with that."

"We'll take that up again with the second fundamental, some evening next week, shall we?" Mac said.



1 INK MIST is deposited on the automatic filters at left. Units above at the Washington, D. C., *Times Herald* exhaust individually through an outside wall

• With the advent of high speed press machinery, ink mist became a critical problem in modern newspaper publishing. Not only pressrooms but mail rooms and other parts of some buildings, too, were plagued by the soiling mist.

To minimize the deposit of ink mist, and to remove heat,

Solving the Ink Mist Problem

By James W. May
American Air Filter Co.

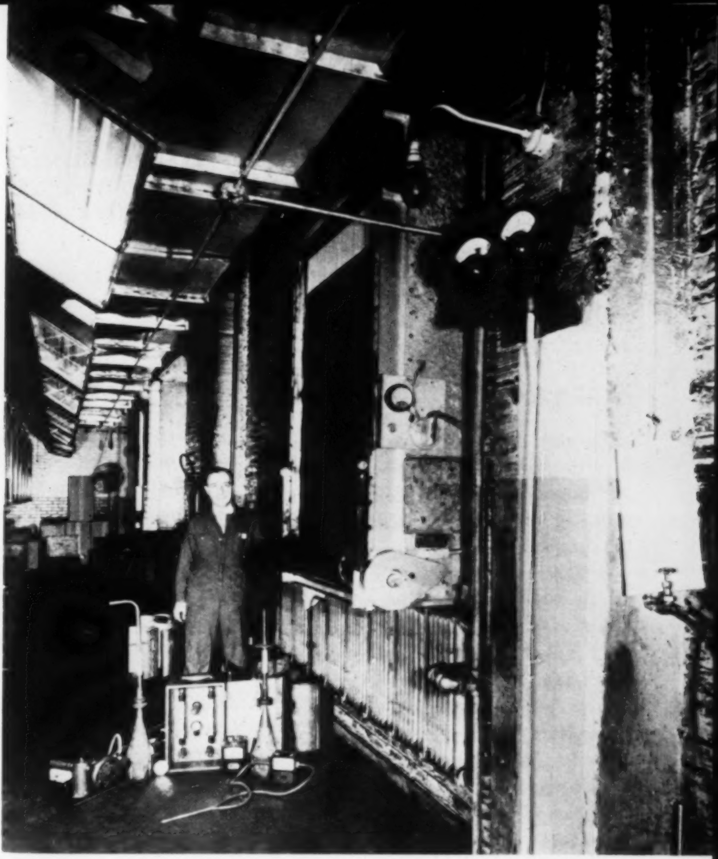
THE REMOVAL of ink mist from the air in newspaper pressrooms has always presented a problem with respect to the maintenance of the collection equipment. Ink mist, by its very nature, is sticky or tacky and has a tendency to adhere to every surface which it contacts. The attendant paper dust generated by the folding and slitting operations forms a convenient nucleus for the growth of lint globules and serves to complicate the problem. The situation has also been further aggravated by the advances made in press design to obtain higher operating speeds which has resulted in increased amounts of ink mist being liberated into the pressroom area.

Ink mist has tremendous soiling properties and when allowed to disperse into the pressroom not only adds immeasurably to the housekeeping chores, but also results in additional equipment maintenance. It is customary to exhaust pressrooms and maintain a slight negative pressure to prevent the escape of the ink mist to other portions of the building. The exhaust air must be cleaned with some type of air filter to prevent defacing adjacent structures.

Automatic Dry Filters Used

One of the recent developments in the air filtration field has been the introduction of an automatic dry type

large quantities of air are, therefore, passed through pressrooms and discharged to the outside. To prevent the ink discharged from defacing other buildings and to protect the discharge units themselves from ink deposit, automatic dry type air filters are installed ahead of the fans.



2 AUTOMATIC AIR FILTER UNITS at the Fort Wayne, Ind., *News Sentinel* discharge into a common duct so that some of the air can be recirculated

. . . in newspaper pressrooms with automatic air filters

filter. The high order of cleaning efficiency provided and its freedom from maintenance makes it particularly attractive for this application.

The filter was originally developed for the removal of lint from recirculated air in textile mills. Its freedom from maintenance made it natural to survey other fields of application where the maintenance of the air cleaning equipment had always presented a problem.

The filter consists essentially of an endless screen curtain of woven stainless steel wire which rotates over top and bottom rollers in a vertical filter casing. The filtering media, a paper type cellulose tissue composed of two plies, is supplied in rolls of 400 ft long. The fresh roll of clean media, mounted on brackets on top of the filter casing, is transported down the face of the filter by the rotating screen. The top and bottom portions of the filter casing are equipped with seals so that all of the air being handled must pass through the cellulose media. After the paper accumulates its dirt load, the dirty media is automatically rerolled at the bottom of the filter.

The stainless steel screen is rotated by a fractional horsepower motor operating through a gear reducer and chain drive, and the operation of the drive motor is controlled by a pressure switch. As the filter media becomes dirty, it offers more resistance to air flow. When this resistance rises to a point coinciding with the setting on the pressure switch, the electric circuit is closed and starts the drive motor that rotates the screen. After a sufficient amount of clean media has been added by the rotating curtain to cause the resistance to be reduced to the proper level, the switch then opens the motor circuit and the filter curtain remains stationary until the resistance again builds up to the predetermined operating point. This method of controlling the curtain movement apportions the media usage to the amount of ink mist in the air. Mounted along side the pressure switch is an indicating pressure

. . . The rate of filter media usage is controlled by the resistance differential across the filter curtain . . .

gage so that the resistance imposed by the filter can be determined at all times.

Filter Tested in Pressroom

Because of the obvious difficulties in attempting to simulate newspaper pressroom conditions in the laboratory, arrangements were made with the Louisville, Ky., *Courier Journal and Times* to install a test unit in its pressroom. This pilot unit consisted of a small size unit connected by a sheet metal housing to an exhaust fan. The unit was mounted on casters and placed in an aisle between two rows of presses and operated so as to simply recirculate the pressroom air. A wide variety of tests were conducted to determine collecting efficiency and optimum operating conditions for the filter. With two ply media and air velocities through the filter curtain in the order of 480 fpm, it was possible to obtain weight efficiencies of 98 percent.

How Filter Operates

Aside from its high cleaning efficiency, the freedom from maintenance of the filter makes it particularly suitable for ink mist collection. In an average pressroom, a clean roll of media should operate from five to seven weeks, and changing of the media rolls is a very simple operation. The dirty rolls of ink laden media can be disposed of by burning or in any suitable fashion. Since the rate of media usage is controlled by the resistance differential across the filter curtain, the rate of resistance rise of the media is a direct function of the amount of ink mist in the air being handled. When the concentration is low, the curtain will move less frequently and this means that no special attention or adjustments of the filter are necessary to meet the changing operating conditions in the pressroom.

The entering air side of the filter is generally visible to the pressroom personnel, and the last few feet of each roll of media is supplied with a color stripe down the center so as to serve as a warning that the media is nearly exhausted. For those installations where the unit is installed in a system of duct work, there is available an alarm which attaches directly to each section. By taking advantage of the fact that the filter operates within a definite range of velocity, it is possible to utilize extreme points of this range to operate a warning switch. This switch consists of two different size vanes which actuate two individual micro switches. The small vane is sensitive to high velocities, which might result from a hole or tear in the media. The large vane functions in a reverse manner and is actuated by the absence of air flow. The last 18 in. of each media roll is provided with a strip of kraft paper of such density as to be impervious to the flow of air. When this portion of the media is fed across the curtain, the presence of the kraft paper prevents any flow of air through that portion of the filter face. This immediate reduction in air velocity causes the large vane to reposition itself by gravity and thereby actuates its micro switch. Both of these micro switches are of the double throw type and are wired through the pressure switch on the filter unit panel. Either a tear in the media or a run-out of the media roll will cause the drive motor circuit to open and the signal circuit to close. The curtain drive motor will not again operate until the trouble is located and corrected.

Typical Installations

The first pressroom installation of the automatic filter was made at the *Milwaukee Journal*, where a new exhaust system was installed. The original exhaust system had become inadequate with the higher speed presses and the attendant increase in ink mist.

Four separate exhaust systems, each consisting of an exhaust fan, plenum chamber and duct connections and two filter sections, were installed, with each filter section handling 5000 cfm. The exhaust fans discharge directly out-of-doors. In this original installation, the plenum chambers were sized so as to provide sufficient space for the installation of electronic precipitators behind the filter units. The high degree of air cleaning provided by the filter made it unnecessary to install the electronic units.

Five separate exhaust units are installed along the outside wall of the Washington, D. C., *Times Herald* as shown in Fig. 1. Each exhaust unit consists of a filter and fan to handle 6000 cfm. The filter units are suspended from the ceiling, with the air flow being directed up through and across the presses so that the ink mist generated migrates to the individual filters before it has an opportunity to disperse into the room.

Fig. 2 shows two units installed along an outside wall of the Fort Wayne, Ind., *News Sentinel*. These units discharge into an overhead exhaust system so that a portion of the air can be recirculated during the winter. Each of these units has an air handling capacity of approximately 8000 cfm.

In each of these illustrations, the filters are exposed directly to the room and are located as close to the presses as practical. The omission of any duct work on the air entering side of the filter and the high efficiency of the unit have resulted in reducing to a minimum the maintenance associated with ink mist collection.

In existing pressrooms floor space is often limited. Under such conditions it may be necessary to locate the filters near the ceiling.

THE LAW AND YOUR PROFITS

By William Hurd Hillyer

Should You Arbitrate?

A CONTRACT which contains an arbitration clause should be entered into with both eyes open. Arbitration findings are a law unto themselves and may prove costly to the contractor. This stands out in a recent case.

Insta-Tution Heating Co. had a written subcontract with the State Building Commission for the installation of a heating system at the School for the Blind. (All names herein are fictitious.) When the general contractor had almost completed his work, the architect found the heating firm so far behind on its contract that completion within the specified time limit would be virtually impossible.

This situation was reported to the Commission, which at first determined to cancel Insta's contract. But upon Insta's assurance, the Commission deferred action for three or four months. At the end of that period, the architect, still dissatisfied, officially informed the Commission that the heating contractor was hopelessly in default. Thereupon the Commission declared the contract terminated and called on the contractor's surety to complete it. The heating contractor demanded arbitration, according to the contract's terms.

After a 10 day hearing of evidence and argument, the board of arbitration made a general award in favor of the State Building Commission and found that the architect had sufficient cause for his action. Insta took the case to the next higher court, where he tried to get the award vacated. There, also, he sued the Commission for the balance due under the heating contract.

WILLIAM HURD HILLYER, author of this regular feature, is a contributor to a number of banking and financial publications and has written several books on business. A former vice president of the Atlanta Trust Co., his work there gave him a practical legal background.

A special judge, to whom the court referred the matter, took two years to decide that the arbitrators' award was "incomplete." The courts handed the case back to the arbitrators for further consideration. This time the board made 15 specific findings, instead of one, all of them adverse to Insta-Tution. A year later the heating contractor asked the court to upset this "supplementary" award, but the arbitration judge confirmed both awards. From his decree, the heating contractor appealed.

The arbitration awards, Insta-Tution contended, were not valid because (1) the original finding was incomplete; and (2) the 15 supplementary findings were not made within the specified time limit. He further claimed that there was not sufficient cause for the architect's certificate upon which the Building Commission terminated the contract.

Said the state supreme court: "The trouble" with such contention "is that the general award necessarily constituted a denial" of the contractor's "claim under the so-called 15 points." The court enumerated the following facts "necessarily adjudicated" by the award:

1) That the sub-contractor (Insta) had failed to furnish a sufficient number of skilled workmen and proper materials.

2) That he had persistently disregarded the architect's instructions.

3) That he could not complete his work satisfactorily and in accordance with specifications.

4) That sufficient cause existed to justify the Commission in terminating Insta's contract.

5) That his day-to-day progress on the job was not in keeping with the Commission's order which, in effect, had put him on probation before his contract was terminated.

6) That the Commission did right in taking Insta off the job and calling on his bond surety for completion.

In the supreme court's opinion, an agreement to submit a controversy to arbitration has the legal effect of a compromise settlement of all matters in dispute. A further effect of such an agreement is to make the written award the exclusive source of the parties' right and liabilities.

To make its position more positive, the higher tribunal quoted from one of its previous decisions: "Nothing in the award relative to the merits of the controversy as submitted, however wrongly decided, is ground for setting aside an award, in the absence of fraud, misconduct or other valid objections." As laid down by the court, the general rule is that arbitrators *"are the final judges of both law and fact."* More specifically, "the rights of parties are narrower than in judicial trials, for there is no review or correction of errors" either upon facts or law; nor indeed are arbitrators absolutely bound by strict legal principles. They may proceed altogether on views of what is right and just between parties without following the rules that would govern a court of law or equity.

Apart from emphasizing the need for diligence and cooperation in the performance of a contract, Insta's predicament shows that the services of arbitrators are not to be lightly invoked. No holds are barred, their decisions are virtually final, and their mistakes, if any, cannot be rectified by legal appeal.

[Note: While this discussion applies to an actual case, it should be remembered that legal rules vary in different states.]

QUESTION OF THE MONTH

What Causes Book Pages to Crinkle?

THE QUESTION, *What Causes Book Pages to Crinkle?*, was published previously in HPAC and is repeated here for information along with an answer to the question that has been received. Other comments for publication will also be welcome.

"A bookstore in Montana with a 250,000 volume stock of used books suffers considerable loss from warping and crinkling of the paper pages. It is not practical, however, to install air conditioning, or even to provide a well insulated, heated building since the books are mostly low priced. The damage occurs during severe cold spells.

"The building, on a well drained site, is partly floored with concrete. Part has dirt floor topped with gravel, then concrete blocks. Over the blocks is a platform on which book stacks stand. Part of the building has a double ceiling and part has side walls which are provided with double sheathing and two layers of tarred felt and an exterior of aluminum sheet metal.

"Books moved to the heated office during cold spells quickly warp unless humidity is kept up, but in distant unheated parts of the building, cold alone seems to warp and buckle the paper. Is this caused by the small amounts of moisture traveling in and out of paper? Extreme cold has the same effect as extreme heat; both cause rapid dehydration and consequent wrinkling. On the other hand, vapor pressure decreases with the temperature. But does not vapor pressure cause moisture migration? Yet books placed in the owner's deep freeze don't seem to buckle at zero F. Is it the lack of moisture and/or moisture movement due to temperature extremes? Ventilation or the lack of it does not seem to help. Will cold alone do real damage, or are there unrecognized factors present?" —D.L.

EDWARD F. WEHLAGE —

"Dampness Is Only Thing That Causes Crinkling"

COLD ALONE will not do real damage to books. This is substantiated by the experience encountered when books were placed in a freezer at zero F. At low temperatures, the materials in the binding might become brittle and be damaged in use. The books in this freezer may not have been saturated with excess moisture, but a book that is damp may warp when placed in a freezer, unless it is held under weights until the moisture content is stabilized.

A great deal of information is presented in this problem, but one central fact has been overlooked, and that is a record of the actual relative humidity for the space during the period in question. The construction of the building with a partially unpaved floor is exactly the kind that will ordinarily develop high humidity and allow the books to pick up a great deal of moisture.

There is only one thing that will cause a book or any paper to warp and buckle, and this is plain ordinary "dampness" coupled with changes in the humidity at which the paper is stabilized.

Moving a book from a damp spot to a drier room will result in buckling unless the book is kept under weights or in a press until it has reached a stable moisture content that matches its new surroundings.

Anyone interested in the problem of handling paper would do well to write to the Hammermill Paper Co., Erie, Pa., and ask for a copy of their book, "Relative Humidity." A few quotations from this book are given below:

> "Paper is composed of millions of hollow straw-like cellulose fibers which respond to every slight change in atmospheric conditions. They expand when absorbing moisture and contract when giving it off. Either of these conditions may take place very quickly — 90 percent of the change is probable in the first 10 minutes or less of exposure.

• *YOU ARE INVITED to contribute a question for publication, or an answer to a published question. Please address your reply to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

READER ASKS —

"How Can Boiler Feed Pumps Be Selected for Best Performance?"

"I am looking for the latest available information which will guide me in selecting boiler feed pumps for steam plant service. Larger boiler feed pumps now required with the higher operating pressures in modern steam plants result in higher first costs and higher operating costs if one pump is selected rather than several.

"Is there some rule of economics that can be applied after considering the pump characteristics and sizes available to meet the requirements? Of course, reserve capacity, available with more than one pump, is a big advantage that must be considered, but the maintenance costs may be greater with several pumps.

"I hope that some helpful information can be published on this subject, as other engineers are probably concerned with this problem too."—J.W.M.

"Up to the present time, no way has been found to manufacture printing paper that will not be affected by changing humidity conditions. Paper made of cellulose is by nature hygroscopic and reactive to moisture; therefore, the facts must be faced, the action and effects of humidity understood, and the best remedy applied under prevailing conditions.

"Hygrometer and thermometer readings are directly related in understanding what relative humidity is doing to any kind of paper and its handling.

"A number of different conditions of temperature and relative humidity are advocated by different authorities, although there is no disagreement in basic principle. The following are about average:

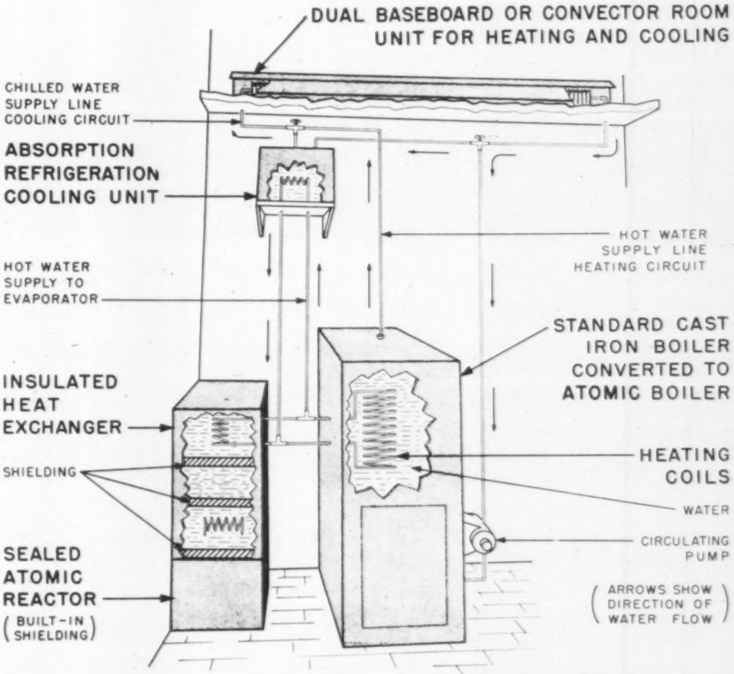
" 'Where it is possible to have a uniform condition all the year around, it is generally agreed that 75 F to 80 F at 55 percent humidity is ideal.' "

A considerable portion of my personal library is stored in basement rooms at my home. Practically the entire basement is below grade. Left uncorrected, the humidity would become excessive during the summer. This resulted in the buckling of pages. However, since I have installed a portable dehumidifier, damage to books and papers has been eliminated and the woodwork has been kept in good condition.

If a recorder for checking the humidity could be installed, and then controlled with the use of dehumidifying apparatus or humidifying equipment, the only problem needing attention would be the proper mechanical handling of the storage of the books.—Edward F. Wehlage, Mechanical Engineer.

Atomic Boiler Being Developed

. . . for year 'round air conditioning


DUAL BASEBOARD OR CONVECTOR ROOM UNIT FOR HEATING AND COOLING
CHILLED WATER SUPPLY LINE COOLING CIRCUIT
ABSORPTION REFRIGERATION COOLING UNIT
HOT WATER SUPPLY LINE HEATING CIRCUIT
HOT WATER SUPPLY TO EVAPORATOR
STANDARD CAST IRON BOILER CONVERTED TO ATOMIC BOILER
INSULATED HEAT EXCHANGER
HEATING COILS
SHIELDING
WATER
CIRCULATING PUMP
SEALED ATOMIC REACTOR (BUILT-IN SHIELDING)
(ARROWS SHOW DIRECTION OF WATER FLOW)

ATOMIC BOILER SYSTEM PROVIDES
1. HOT WATER HEATING FOR WINTER
2. CHILLED WATER COOLING FOR SUMMER
3. YEAR 'ROUND HOT WATER
4. SNOW MELTING FOR WALKS AND DRIVEWAY

The principle of using waste heat from atomic energy installations to heat large buildings — first at Harwell, England (HPAC for January 1952), then at Hanford, Wash. (HPAC for February 1954) — is now being developed for smaller buildings, as explained by Robert E. Ferry, general manager of the Institute of Boiler and Radiator Manufacturers at its 40th anniversary meeting recently. He foresees as a "practical reality possibly within a few years" an atomic year 'round heating-cooling system, powered by a baby nuclear reactor connected to a boiler.

The "A-Boiler" system — explosion-proof and safe from radioactivity — will both heat and cool a small building, for example, approximately six years on a single charge of fissionable material hermetically sealed within the multiple-shielded "portable" reactor. About twice the size of an auto battery, the reactor would be replaced with another sealed unit at the same price after its charge has been exhausted.

The A-Boiler system — which can be added to existing heating boilers without removing them — will provide chilled water cooling in summer, hot water heating in winter, virtually unlimited year 'round domestic hot water, and heat for melting snow from walks and driveways.

Summer cooling by the A-Boiler system would be accomplished by an absorption refrigeration unit. Water chilled by the unit would be piped to forced convectors. In winter, the same sealed piping circuits — a nonradioactive heat transfer medium — would carry hot water, as in a modern conventionally fueled hot water heating system.

Once installed, the sole "fuel" expense thereafter would consist of "recharging" every six years or so by exchanging the exhausted reactor for a fresh one, factory adjusted, sealed and pre-controlled. Life of the system equipped with a cast iron boiler would be 40 or more years.

Industrial Air Conditioning for Health and Safety Makes Progress

By Allen D. Brandt
Chief Industrial Hygiene Engineer
Bethlehem Steel Co.

. . . control of the industrial environment and air pollution measurement and control discussed at AIHA meeting

SEVERAL ADVANCES were reported in industrial air conditioning at the recent 16th annual convention of the American Industrial Hygiene Association in Buffalo. Among them were the determination of pressure loss characteristics of flexible exhaust hose, improved methods of sampling and analyzing air pollutants, and progress toward the determination of the tolerance limits for physiological strain from working in high temperature environments.

In all, 73 papers were presented in the three day convention, most of them dealing in one way or another with the control or regulation of the industrial environment.

Pressure loss characteristics of flexible exhaust hose reported by Dr. Leslie Silverman, of the Harvard school of public health, fill a long-standing void in the design of local exhaust systems. Exhaust systems frequently require flexible hose to be connected to moving pieces of equipment. In the absence of friction loss data for such tubing, it frequently was difficult to select a fan scientifically. And in multiple systems it was often impossible to accomplish system balance except by the use of blast gases.

The judicious use of local exhaust ventilation was recommended for reducing the air contamination by Benjamin Feiner, of the New York state department of labor, in a report of a survey of 16 typical paper pulp mills.

Determination of the tolerance limits for working conditions in so-called hot industries may be nearer possibility, according to H. S. Belding, of the University of Pittsburgh graduate school of public health, who discussed the various forms of heat injury from physiological strain produced by exposure to high temperature environments. The three basic responses to heat which determine the overall strain, he said, are: (1) adjustments of the circulatory mechanisms by which blood flow to the skin is increased; (2) operation of the sweating mechanism; and (3) elevation of body temperature.

Threshold limits provide the only available basis for engineering control of the industrial atmosphere. They play a singularly significant role in industrial health, efficiency and production. Despite their shortcomings, they are indispensable in the absence of a better yardstick. The pros and cons of threshold limits were discussed in a half-day session.

Toxicology of many materials, including plastics, rubber, and certain insecticides, were discussed in eight papers. The results from recent studies of the retention of airborne particulates — solid and liquid — in the human respiratory system were presented in one paper.

Different aspects of the measurement of concentrations of contaminants in the atmosphere were discussed in eight papers. These reports covered problems both in sampling and in analysis.

A variety of papers were given on the subject of air pollution and its control. One discussed trends in the public thinking on this. Others covered the significance of certain air pollutants, the dangers of using industrial hygiene standards in air pollution evaluation, and the sampling and analysis of air pollutants, both in stacks and in the community.

ON THE JOB

Plastic Pipe Used on Navy Minesweeper

. . . to help shun magnetic mines

RIGID PLASTIC PIPE is used in place of metal pipe on one of the Navy's newest minesweepers, U.S.S. "Cormorant," to handle bilge, cold salt water for fire mains, and cold fresh water. It is also used in voice tubing, says the B. F. Goodrich Co.

With its 144 ft hull made entirely of wood, the ship probably has less metal in it per square foot than any other type of Navy ship. The purpose is to discourage the attraction that exists between metal ships and magnetic mines.

The same rigid plastic in sheet form is used for the ship's Diesel oil collector tanks and water tanks. Both pipe and tanks have been tested under actual service conditions for more than a year aboard ship. The pipes are 1 to 4 in. in diameter.

Nomograph Simplifies Duct Design

By Robert W. Ruppert
Mechanical Engineer

THE DESIGN of exhaust, ventilating, and dust collecting systems may be simplified by using the nomograph on the following page in which values for air flow, velocity, velocity pressure, duct diameter and area are given.

In one operation, this nomograph solves three equations used in air flow determinations and on one sheet provides data that is usually compiled on two or more pages in handbooks. This chart may also be of value to engineers by aiding them in quick field calculations.

The three equations solved by this chart are the familiar:

$$Q = VA \quad \text{[1]}$$

$$VP = [V/4006]^2 \quad \text{[2]}$$

$$A = \pi/4[d/12]^2 \quad \text{[3]}$$

where Q = air flow rate, cfm (standard air); V = mean velocity of air flow, fpm; A = flow area of round duct, sq ft; VP = velocity pressure, in. of water gage; d = diameter of round duct, in.; and 4006 = a constant.

The use of this chart is best explained by an example:

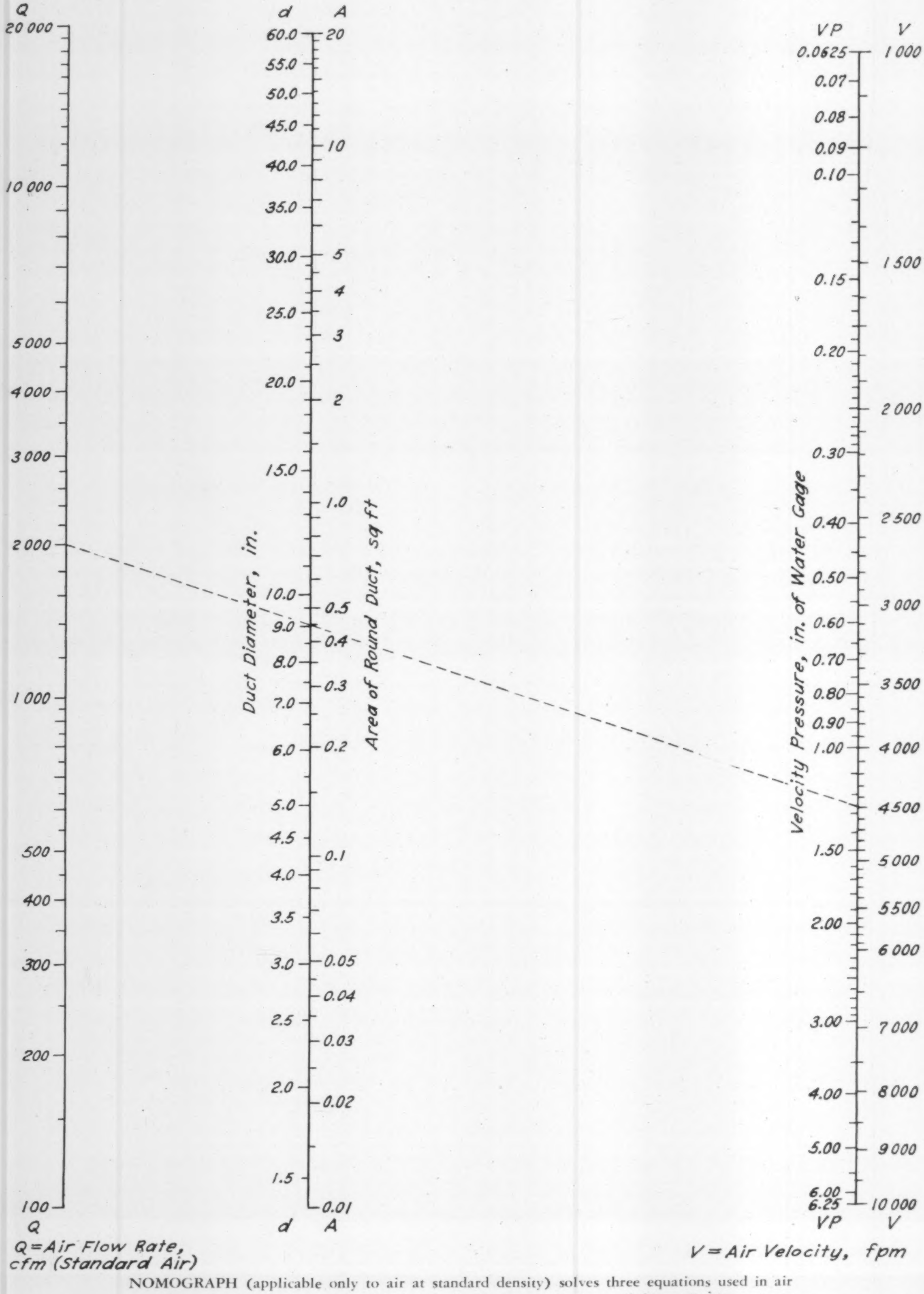
Problem: An exhaust system is to deliver 2000 cfm of air at standard conditions. In order to convey certain particulate matter in the airstream, the mean velocity is to be 4500 fpm. What size round duct must be used and what will be the velocity pressure used in computing system losses?

Solution: Connect 2000 on the Q scale with 4500 on the V scale by a straight line. At the intersection of this index line and the d scale, read d = 9 in. (A = 0.44 sq ft); on the VP scale (adjacent to 4500 fpm on the V scale) read velocity pressure = 1.27 in. WG.

If any two of the five variables are known, the other three may be determined immediately.

The chart is also useful for obtaining the velocity pressure when the velocity is known and vice versa. Simply read the VP opposite the value of the velocity on the adjacent scale.

The area and duct diameter scales can be used in the same way. Knowing the required flow area in square feet, the diameter of a round duct to give this area may be found by reading the diameter on the d scale adjacent the given value of area on the A scale or vice versa.



NOMOGRAPH (applicable only to air at standard density) solves three equations used in air flow determinations and simplifies the design of exhaust, ventilating, and dust collecting systems

HEATING, PIPING & AIR CONDITIONING

AMERICAN SOCIETY OF
HEATING AND AIR-CONDITIONING ENGINEERS

Journal Section

The object of the Society is to advance the arts and sciences of heating, ventilating, cooling and air conditioning, and the allied arts and sciences, for the benefit of the general public, to encourage and conduct scientific research, and to cooperate with other organizations having the same or similar objectives.

Air Conditioning Coil Odors

By A. B. Hubbard*, Bloomfield, N. J., Nicholas Deininger**
and Frederick Sullivan**, Cambridge, Mass.

SUMMARY — Some components of familiar environmental odor blends accumulate on cooling coil surfaces and reappear in air-conditioned spaces during off-cycles. The modified odor blend is objectionable and not readily connected to odors originally created on the premises. The condition does not respond to ordinary remedies. Coil odor was reproduced in a test room under controlled odorant input conditions, and a simplified method is described for evaluating strips of material. Results of organoleptic observations are reduced to three factors combined in a coil quality rating which predicts odor performance in practice. The best surface sparingly picks up only the more acceptable odors and releases these rapidly to avoid undue build-up. Ratings of a variety of materials and surface treatments are given. It is concluded that aluminum, tinned copper, and bare copper rank in that order. A treatment is described for further improving aluminum.

EXTENSIVE field investigations and thorough laboratory experiments have established a method of predicting the odor performance of cooling coils used in air conditioning. The equipment designer not experienced along these lines may, in choosing coil surfaces, set up a small but troublesome probability of complaints of foul odor easily traceable to the air conditioner discharge grille or duct.

It is necessary at the outset to distinguish carefully between two categories of odor trouble. The more common odor complaint is the result of too much tobacco, food, body odor, or combinations of these being produced for the amount of ventilation or infiltration air available to dilute them. The offending odors plainly indicate their origin, such as tobacco, food or body odor. Installers and servicemen are prepared to correct such situations through intelligent appraisal and action. The routine odor difficulty has two unique characteristics; the odor is easily identifiable as to origin, and the air-conditioning system is not its focal point. There is no need to elaborate on this ordinary odor problem.

The other type of odor trouble is the subject of this paper and is called by experienced servicemen, *air-conditioning odor*, *coil odor* or *air-conditioning coil odor*. Coil odor is not only very foul and disturbing, but is both foreign and familiar to every layman. It is foreign in that such a blend never occurs in any other connection. It is familiar because coil odor vividly reminds each person of his most revolting odor experience. Different people may describe the same odor situation in terms varying from *stale cigar butt* through *rotten eggs* to *dead rat*. Another distinctive symptom of coil odor is that it clearly comes from the air conditioner. The onset of coil odor takes one of two forms. It may appear in full force within a week of installation. On the other hand, the early indication may be only a puff of foul odor during the morning start-up. In either case, the premises may be overwhelmed for several weeks during September and October, particularly when a long sustained spell of hot weather suddenly moderates.

A research program, active for almost four years, was started in the Fall of 1948. The opening phase of the program was a lengthy field investigation of *store cooler* installations in highly industrial and commercial districts of New York, New Jersey and Philadelphia areas. A team of engineers visited a large number of air-conditioned commercial establishments, mostly selected at random, to obtain first-hand knowledge of odor conditions and to discuss these with users. Due to the difficulty of describing odors, normal channels had generally produced vague and contradictory information. It was felt necessary to build up a solid foundation of facts before a scientific approach could be planned.

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**Senior Research Chemist, Arthur D. Little, Inc.

Presented at the Semi-Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, San Francisco, Calif., June 1955.

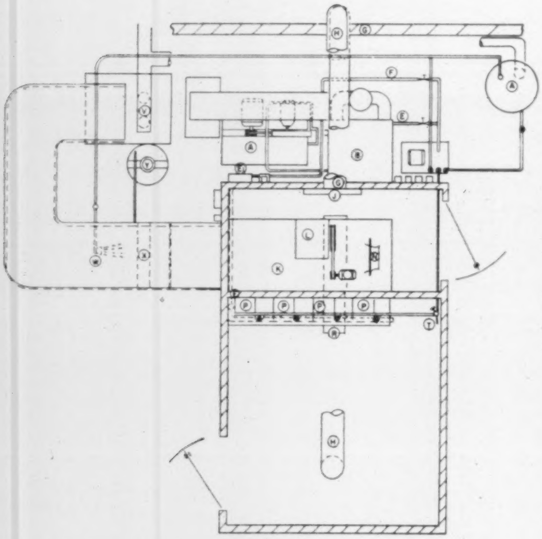
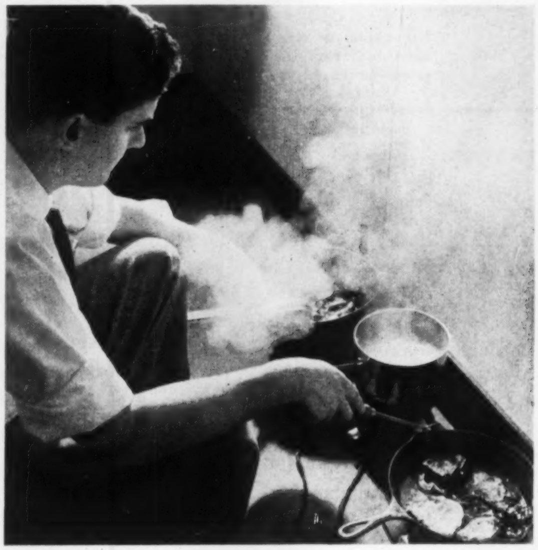


Fig. 1—Plan view of test room

(A) F-12 Condensing Unit. (B) Cooler. (C) Circulation Pump. (E) Water Inlet. (E¹) Water Outlet. (F) Chiller By-pass. (G) Outside Air Intake Duct. (H) Air Exhaust Duct. (J) Glass Fiber Filter. (K) Mixing Chamber. (L) Blower. (N) Temperature and Humidity Recorder. (P) Experimental Coils. (R) Air Recirculation Duct. (S) Water Manifold. (T) Water Pressure Gauge. (U) Gas-fired Water Heater. (V) Gas-fired Furnace. (W) Water Spray. (X) Capillary Cell Humidifier. (Y) Condensate Pump.

Fig. 2—Introduction of food odors in the smaller chamber of the test room



Field Investigation of Odors

Early in the field study two classes of odor difficulty, as just described, became apparent, and it was clear that effort should be concentrated on further investigation of the coil odor phenomenon. The survey revealed 13 installations having coil odor and to which experimental access could be arranged.

The selected coil odor cases had in common varying degrees of tobacco, food and body odor as suspected primary sources from which odor accumulation could be drawn. All these units had bare copper coils. Although bare copper had been used successfully for over 15 years, it was decided to test the persistent rumor that copper accumulates foul odor. One store cooler was selected for experiment. This unit was in a night club with year-round cooling load, and there were competitive units, with different coil surfaces, on the same premises. Highly thinned red alkyd base paint was flow-coated on the copper coil surface in place. When improvement was noted, the remaining installations selected for experiment were similarly treated one at a time as justified by preceding experience. Results proved fair to excellent.

The investigating team of engineers inspected each of the experimental jobs at monthly intervals for a period of one year. Visits to other installations were also kept up to provide general experience and a basis for comparison.

Various approaches were made to determine the mechanism of coil odor. For example, numerous samples of condensate were collected and analyzed. Parts per million concentrations of many contaminants were noted. These included sulfates, nitrates, nitrites, chlorides and phenol. Some of these correlated fairly well with coil odor conditions. However, glaring exceptions were evident, and no individual condensate analysis could be used to predict susceptibility to coil odor.

After a year of experience, the field investigating team had accumulated a store of empirical know-how, but found itself in an unsatisfactory situation. Odor trouble could not be accurately predicted, and the ability to diagnose air-conditioning odor and prescribe corrective action could not be readily transferred to others. No positive conclusions of importance could be stated. For instance, it could only be said that a very small percentage of bare copper coils would develop odor; the majority were acceptable, and many were excellent. It could not be said that tinned copper coils were immune to odor; investigation had turned up some aggravated cases of odor on such coils. Coil odor is unknown in some areas and fairly common in others. Some establishments, such as a particular delicatessen-meat market, had a high level of odors of all varieties, but no signs of coil accumulation. On the other hand, there was the unlikely case of coil odor in an appliance showroom with no discernible background odor except from smoking during infrequent sales meetings.

Thus it was apparent that the research program should go into a laboratory phase where scientific methods and controls could be used to clear up the contradictions and answer the questions raised by the field study. It was further apparent that the objective of a laboratory program should be to reveal the mechanism and fundamentals of coil odor. Arrangements were made to take up the scientific phase in an Odor and Flavor Laboratory in Cambridge, Mass., and the program called for close cooperation between the field study team and the laboratory engineers and scientists with related odor skill and experience.

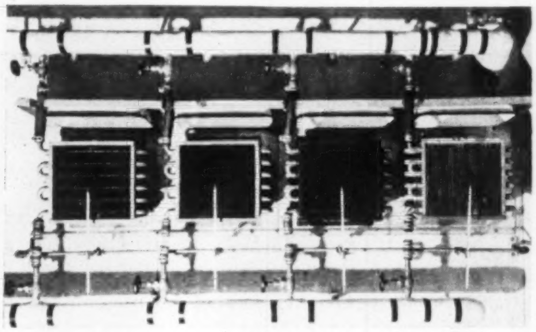


Fig. 3—Four experimental coils as viewed by observer in the panel examination room

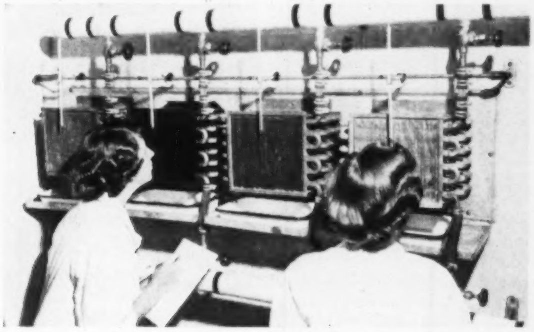


Fig. 4—Panel members testing experimental coils in examination room

The first move was to design and construct a test room where four conveniently small coils, having different surfaces, could be operated under controlled odor input conditions. It was then necessary to adapt a suitable method of odor measurement, to develop test procedures and to analyze data to rate the odor properties of various cooling coil surfaces.

Odor Test Room

The odor test room, constructed of asbestos-cement board, had overall dimensions of 8 x 12 ft with a 7½-ft ceiling. The room was divided into two chambers; one chamber (8 x 4 x 7½ ft) served as the odorant introduction room; the other chamber (8 x 8 x 7½ ft) contained the test coils and was used as the panel examination room. Fig. 1 is a top-view drawing of the test room with apparatus and equipment labeled. The smaller of the two chambers of the test room is used for the direct introduction and mixing of the specific odorants and outside air prior to circulating the mixture over the coil surfaces. The odorants selected were tobacco smoke, cooking food odors, synthetic perspiration sprays and combinations of these. These odorants had been suggested by the Technical Advisory Committee on Odors of the American Society of Heating and Air-Conditioning Engineers as being the most likely offenders in air-conditioning systems. Fig. 2 shows the method of introducing food odorant. Fig. 3 shows an arrangement of four experimental coils in the panel examination room.

In this test room it was possible to reproduce coil odors in a standardized way which almost exactly duplicated actual conditions observed in the field. The characteristic behavior of test coils made of different metals and having different surface treatments could be readily evaluated. The test room made it feasible to study the accumulation and modification of specific odorants on the experimental coil surfaces during the cooling period, the subsequent release of odor components with an increase in coil temperature and the extent of odor retention after a return to initial cooling temperature.

Odor Measurement

Odor evaluations were made by a trained panel using an adaptation of the Flavor Profile method of Cairncross and Sjostrom[1]. Each panel member smells the air leaving the coils and writes down odor notes perceived, using descriptive terms such as *sour, burnt,* or *rubbery;* and decides on the intensity of each note using a number scale ranging from *threshold* (just perceptible) to *very strong.* Findings are discussed fully by the panel in open session after each test until all agree on common terminology. The resulting consensus is an *odor profile* for each coil. After considerable experimentation, the following cycle was established:

1. Normal operation: chilled water is circulated through coils, and outdoor air is circulated through rear chamber, coils and then back to outdoors.
2. Odorant is introduced in rear chamber while chilled water is circulated through coil and test room air is recirculated. Water temperature is adjusted to give 60 F leaving air temperature, and odorant introduction is continued 15 min.
3. Rooms are flushed with outdoor air for 15 min while chilled water circulation is continued.
4. Odor measurements are made by panel immediately after flushing period and while outdoor air flushing is continued. Fig. 4 shows a panel examining four experimental coils.

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[1] Flavor Profiles — A New Approach to Flavor Problems, by S. E. Cairncross and L. B. Sjostrom (*Food Technology* IV (8), 1950, p. 308).

5. Coils are purged of odor accumulation by switching water circulation to stored hot water with temperature adjusted to give 100 F leaving air.
6. Odor measurements are made at the beginning of the purging period and repeated after two 10-min periods.
7. Odor retention is determined by making a final odor measurement after chilled water circulation is re-established and leaving air temperature is again 60 F.
8. Finally hot water circulation is continued to drive off any remaining odors and to prepare coils for another test.

Fig. 5—Panel examining test strips

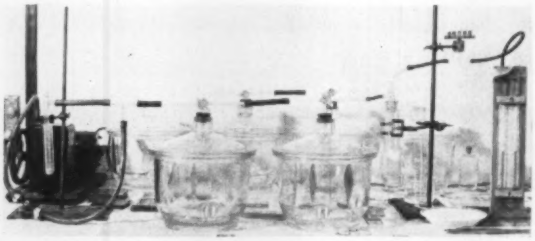


Fig. 6—Apparatus for contaminating test strips

During the tests the humidity was controlled to insure that the coils dripped normally during cooling operation. A special series of tests established that dry coil operation resulted in the least odor pickup, normal dripping operation increased the odor load, and *borderline dehumidification* caused a noticeable worsening of odor performance. This last operating condition is characterized by a heavy coating of moisture on the coil surface with drops clearly seen but with none dripping off.

Explanation of Coil Odor

Air conditioning coil odor is an unnatural blend of odorous substances accumulated on the surface of the coil. It is caused by selective adsorption of various odor components from the normal environmental odors. Some components of a complex odor blend are adsorbed more readily than others, the speed of adsorption and the preference patterns being functions of the kind of surface. An impressive amount of odorous material may collect on a coil surface even though the environmental odor is below or near threshold level. Adsorption is more rapid on a cold surface and is probably influenced by the condensation of water vapor.

When released by the heating or off-cooling cycle, this accumulated odor residue (coil odor) is foreign and objectionable primarily because it is out of context or separated from its normal blend of background odors. The emphasized components of the odor accumulation are generally the more objectionable odors because they are associated with putrifaction, rancidity or uncleanliness.

Common odor blends, for example, tobacco, food and body odors, are not as different as one might suppose. Such notes as burnt-fragrance, sour, sulfide, and animal are common to all three of these odorants. The similarity of tobacco and vegetable odors can easily be demonstrated in the laboratory by comparing the odor produced by passing cigarette smoke and steam through copper wool, with the odor of steam passing through a mixture of cut-up vegetables. The identifying component of tobacco is scalped by the copper so that both appear as familiar boiling vegetable odors.

The fact that coil surfaces do selectively adsorb odors from the air passing over them introduces complications in the analysis of test results. The odorant blends used include at least 30 components or notes, and each kind of surface may pick up any number of these in amounts above threshold. Each picked up component varies in strength depending on the preference pattern of each surface. The acceptability of each note picked up is another variable. Finally, each surface, when warmed, exhibits a different ability to retain each adsorbed odor component. The Appendix outlines the method used to reduce test results to predictions of comparative quality of surfaces to air-conditioning cooling coils.

Rapid Screening of Surfaces

The cost of making and testing actual coils turned out to be too high to permit speculative search for better surfaces. To overcome this, a simple rapid test was devised. Briefly, the screening test consisted of the following steps:

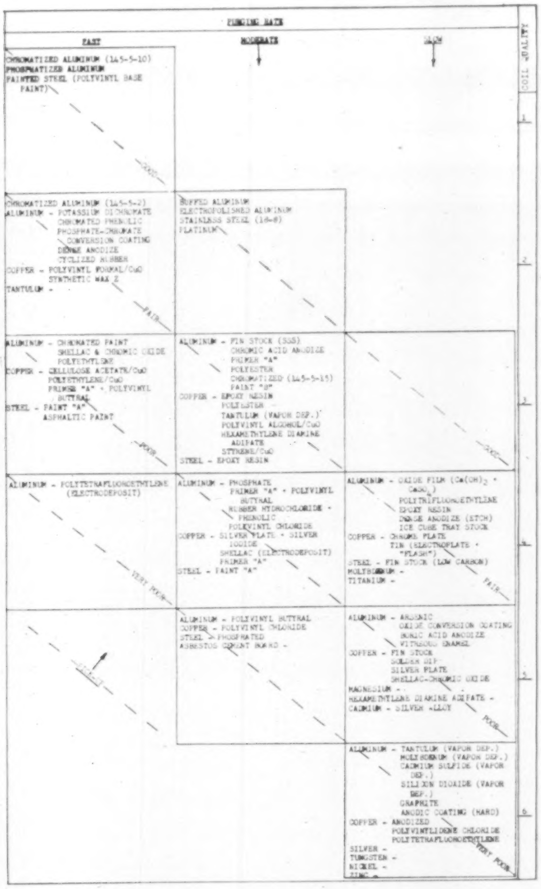
1. Initial examination of 4-in. sq test strips by a trained panel.
2. Contamination by tobacco smoke in saturated air for 1 hr followed by 5 min airing.
3. Odor profiles of contaminated strips by panel at room temperature.
4. Odor profiles of contaminated strips during gentle heating by infrared lamp, special attention being paid to the rate of purging.
5. Final odor profile after cooling contaminated strips to room temperature.

Whenever possible the test strips were baked at 250 F for 4 hrs before being contaminated.

The odor profile procedure has already been outlined. Fig. 5 is a photograph of a typical panel at work. The panel operates in an odor-free room without distraction. For maximum efficiency, each panel member must be completely at ease and confident. The panel leader has the delicate and demanding task of guiding the panel without dominating its judgment or upsetting its morale and confidence.

Each material was rated on the basis of its odor pickup resistance. This was a term used to incorporate both the type and level of odor pickup. The rating scale was divided into four distinct categories, *good*, *fair*, *poor* and *very poor*. For example, if the odor level was low and the type of odor not objectionable, the surface received a *good* rating. Conversely, a surface exhibiting objectionable components at a high level merited a *very poor* rating. The rate of release or the speed of purging the adsorbed odor was also considered to be of major importance. Those materials which rapidly returned to their original odor during the purging period and, therefore, had little or no residual odor were given a *fast* rating; those which lost only a small part of the acquired odor during purging and retained a residual odor of high intensity were given *slow* ratings. Purging between the two extremes was classed as *moderate*.

Table 1—Odor Performance of Surfaces



COIL QUALITY	PURGING RATE		
	FAST	MODERATE	SLOW
1	CHROMATIZED ALUMINUM (145-5-10) PHOSPHATIZED ALUMINUM PAINTED STEEL (POLYVINYL BASE PAINT) GOOD		
2	CHROMATIZED ALUMINUM (145-5-2) ALUMINUM - POTASSIUM DICHROMATE CHROMATED PHENOLIC PHOSPHATE-CHROMATE CONVERSION COATING DENSE ANODIZE CYCLIZED RUBBER COPPER - POLYVINYL FORMAL/CuO SYNTHETIC WAX Z TANTULUM - FAIR	BUFFED ALUMINUM ELECTROPOLISHED ALUMINUM STAINLESS STEEL (18-8) PLATINUM	
3	ALUMINUM - CHROMATED PAINT SHELLAC & CHROMIC OXIDE POLYETHYLENE COPPER - CELLULOSE ACETATE/CuO POLYETHYLENE/CuO PRIMER "A" + POLYVINYL BUTYRAL STEEL - PAINT "A" ASPHALTIC PAINT POOR	ALUMINUM - FIN STOCK (S3S) CHROMIC ACID ANODIZE PRIMER "A" POLYESTER CHROMATIZED (145-5-15) PAINT "B" COPPER - EPOXY RESIN POLYESTER TANTULUM (VAPOR DEP.) POLYVINYL ALCOHOL/CuO HEXAMETHYLENE DIAMINE ADIPATE STYRENE/CuO STEEL - EPOXY RESIN	GOOD
4	ALUMINUM - POLYTETRAFLUOROETHYLENE (ELECTRODEPOSIT) VERY POOR	ALUMINUM - PHOSPHATE PRIMER "A" + POLYVINYL BUTYRAL RUBBER HYDROCHLORIDE + PHENOLIC POLYVINYL CHLORIDE COPPER - SILVER PLATE + SILVER IODIDE SHELLAC (ELECTRODEPOSIT) PRIMER "A" STEEL - PAINT "A"	ALUMINUM - OXIDE FILM (Ca(OH)$_2$ + CaSO$_4$) POLYTRIFLUOROETHYLENE EPOXY RESIN DENSE ANODIZE (ETCH) ICE CUBE TRAY STOCK COPPER - CHROME PLATE TIN (ELECTROPLATE + "FLASH") STEEL - FIN STOCK (LOW CARBON) MOLYBDENUM - TITANIUM - FAIR
5	PICK-UP	ALUMINUM - POLYVINYL BUTYRAL COPPER - POLYVINYL CHLORIDE STEEL - PHOSPHATED ASBESTOS CEMENT BOARD -	ALUMINUM - ARSENIC OXIDE CONVERSION COATING BORIC ACID ANODIZE VITREOUS ENAMEL COPPER - FIN STOCK SOLDER DIP SILVER PLATE SHELLAC-CHROMIC OXIDE MAGNESIUM - HEXAMETHYLENE DIAMINE ADIPATE - CADMIUM - SILVER ALLOY POOR
6			ALUMINUM - TANTULUM (VAPOR DEP.) MOLYBDENUM (VAPOR DEP.) CADMIUM SULFIDE (VAPOR DEP.) SILICON DIOXIDE (VAPOR DEP.) GRAPHITE ANODIC COATING (HARD) COPPER - ANODIZED POLYVINYLIDENE CHLORIDE POLYTETRAFLUOROETHYLENE SILVER - TUNGSTEN - NICKEL - ZINC - VERY POOR

Deininger and Sullivan[2] have described the method in its general application to rating surfaces on odor performance. The description and discussion here covers the special case of rating surfaces with regard to their odor performance in air-conditioning cooling coils.

Fig. 6 shows the apparatus set up and ready to use. The odorizing chambers are standard 10-in. laboratory vacuum desiccators. Each vessel is cleaned and charged with 100 ml of water to provide a saturated atmosphere. Four or five test strips, preferably 4 in. square and about 0.025 in. thick, are suspended on a glass rod. Each chamber is evacuated to 15 mm of mercury. Five cigarettes of assorted brands are placed in a manifold and smoked at a slow and steady rate down 2 in. by controlling the pressure drop across the cigarettes at ½ in. of water indicated on a manometer. To insure a strictly vapor phase odorant, the smoke is led to the odorizing chamber through an impingement tube containing a plug of clean non-absorbent cotton. The remaining vacuum is broken by introduction of clean air. The 1-hr contamination period starts at this point.

Results

Table 1 is a plot of resistance to odor pickup versus purging rate. Surfaces of equal pickup appear on diagonals and of equal purging rate in columns so that the horizontal rows show equal quality coil surfaces. The ideal surface would either pick up nothing or would avoid any release of accumulated odor. While such an ideal is unlikely, it is reasonable that the best obtainable actual surface would sparingly pick up the more acceptable odors and would release these rapidly during off-cycles to avoid undue build-up. This is the *good* and *fast* area appearing as Class 1 in the top row.

Coil quality in Class 2 is exemplified by *fair* pickup in combination with *fast* purging. Another coil of *moderate* purging rate would have to improve its other attribute, pickup, to *good* in order to stay in Class 2. This is reasonable and has been checked repeatedly. Classes 3 and 4 each have three combinations of pickup and purging; Class 5 has two, and Class 6 has one. (Words fail to convey an idea of the poor quality of Class 6 surfaces which avidly pick up the worst stenches and release them interminably.)

Table 1 bears out the old industry rumor concerning bare copper which appears in Class 5 (*poor* pickup and *slow* purging). The same rumor has it that tin coating is the remedy, and this is so to the extent that it promotes copper to Class 4. This finding has been checked with pure sheet tin and also solder coatings on copper.

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[2] Study and Evaluation of the Odor Properties of Surfaces, by Nicholas Deininger and Frederick Sullivan (Annals of the New York Academy of Sciences, Vol. 58, Art. 2, 1954, p. 215).

Anodizing copper (electrolytically induced oxide) degrades it to bottom place along with silver, tungsten, nickel and zinc.

Organic coatings change the odor performance ratings, sometimes for better, other times for worse, but no decisive trend is apparent.

No really practical treatment could be found to raise copper to a significantly higher class. Copper can be upgraded to Class 2 by an expensive wax coating (commonly used to reduce adherence of ice cubes to aluminum trays). The same result can be obtained at considerable cost by a polyvinyl formal coating which requires an oxide substrate.

Noble or exotic metals do not necessarily give odor performance in proportion to their price. Following are some examples: tantalum, platinum and stainless steel in Class 2; molybdenum and titanium is Class 4; magnesium and cadmium-silver in Class 5; and silver, tungsten, nickel and zinc in Class 6.

Aluminum can be upgraded one class by buffing or electropolishing. This is of academic interest only, since such surfaces would not retain their polish in service. The best improvement of aluminum was obtained by mild chromic or phosphoric acid treatment as explained in detail later.

The foregoing results apply to strips tested with cigarette smoke. It should be of interest to compare these with the results of coils tested with tobacco, food and synthetic perspiration odors. Table 2 shows the odor performance of test coils following the same scheme used in Table 1 for the strips. The situation is more complicated because in many cases the coils have fins of one material and tubes of another. Where direct comparisons can be made the results match except in the case of copper. In Table 2 this shows up in Class 4 instead of Class 5, probably due to some fault in the method of reducing the voluminous coil test data to this form.

Direct comparison of all-aluminum, aluminum fins on copper tubes, and all-copper coils indicates that they rank in that order from best to worst. That is, the effect of the copper tubes *shows through* to partly offset the better performance of aluminum.

The chromatized and phosphatized aluminum coils fulfill the promise indicated by the strip tests. The copper-oxidized coil produced unbelievably foul stenches, again predicted by the screening test.

The inclusion of the two vitreous enamel-coated coils ought to be explained. In the early stages of the project some thought was given to constructing glass coils which could perhaps serve as standards of excellence. When no practical way could be found to design a glass coil of reasonable proportions, it was suggested that vitreous enamel might form an essentially glass surface. It can be seen that such enamel either lacks the odor properties of glass or that glass does not guarantee good odor performance.

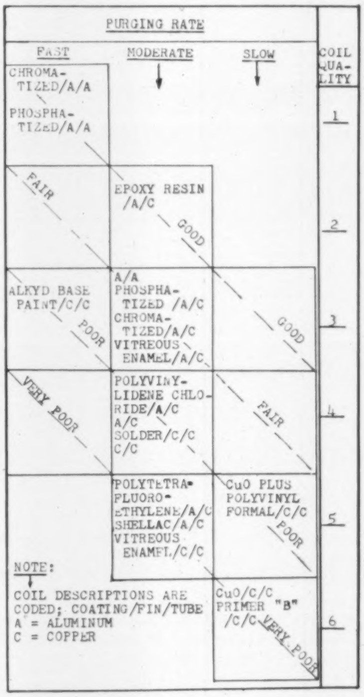
Chromatized and Phosphatized Aluminum: These acid dips are ordinarily used as mild etches to improve the adherence of paint to aluminum. It was found that such dip treatments improved both pickup and purging performance of aluminum. The three main variables of the process are bath temperature, dip time, and acid concentration. These are noted parenthetically in Table 1 in the order mentioned in degrees Fahrenheit, minutes, and percent. The treatment seems critical and, if overdone, the odor improvement may be lost. Several combinations were tried with the various results shown, but the possibilities were not completely explored.

Special tests were made on a group of coils over an extended operating period to determine the life of treated compared to untreated aluminum coils. No significant loss of odor performance occurred in the equivalent of one cooling season.

Many of the coatings and treatments tested in strip form cannot be applied to finished coils, but must be applied to fin stock ahead of fabrication. Chromatizing and phosphatizing, however, are readily accomplished after the coil is completely assembled.

Incidence of Coil Odor: Correlation of field observations and laboratory results permits only the qualitative conclusion that the chances of occurrence of coil odor increase as the class number, according to Tables 1 and 2, increases. No case of coil odor in Classes 1 to 3 has been encountered during five seasons of observation. Previous experience with coils in Classes 4 and 5 indicated less than 2 percent incidence in some areas and negligible occurrence in others. There is no field experience with Class 6 coils.

Table 2—Test Coil Odor Characteristics



PURGING RATE: FAST	MODERATE	SLOW	COIL QUALITY
CHROMATIZED/A/A PHOSPHATIZED/A/A			1
FAIR	EPOXY RESIN /A/C GOOD		2
ALKYD BASE PAINT/C/C POOR	A/A PHOSPHATIZED /A/C CHROMATIZED/A/C VITREOUS ENAMEL/A/C	GOOD	3
VERY POOR	POLYVINYLIDENE CHLORIDE/A/C A/C SOLDER/C/C C/C	FAIR	4
	POLYTETRAFLUOROETHYLENE/A/C SHELLAC/A/C VITREOUS ENAMEL/C/C	CuO PLUS POLYVINYL FORMAL/C/C POOR	5
		CuO/C/C PRIMER "B" /C/C VERY POOR	6

NOTE:
COIL DESCRIPTIONS ARE CODED; COATING/FIN/TUBE
A = ALUMINUM
C = COPPER

It was impossible to predict which installations would develop persistent coil odor and which would be free of it. Laboratory tests gave the broad separation previously outlined but could not duplicate the critical region between susceptibility and resistance to coil odor. The following factors appear to determine between them the probability of coil odor:

1. Concentration and type of environmental odor. Depends on relation between

rate of production of odor and ventilation to dilute odors.

2. Kind of coil surface.

3. Ratio of cooling to off-cycle operation *while fan is running*. This depends on relation between load and capacity, and method of operation by user of equipment. The coil with more off-cycle time is less likely to develop odor.

4. Dehumidifying load. Coil odor is more probable if apparatus dew point remains in borderline zone for long periods. The coil that is wet but not dripping picks up the most odor.

There are undoubtedly additional contributing factors, but to include these would stretch the speculation beyond reason. The geographical pattern fits the theory in the sense that load is steadier and capacity margins are smaller in seaboard climates. In consequence, one would expect less opportunity for these coils to unload accumulated odors.

Conclusions

Objectionable odor level in air-conditioned spaces due to high rate of odor production coupled with poor ventilation is distinguished from the case where the cooling coil surface is the focal point. Coil odors are fairly rare but produce devastating customer complaints, as the odors are most obnoxious and unrelated to normal odors produced on premises.

Laboratory experiments with test coils subjected to controlled contamination and with test strips contaminated by tobacco smoke in closed containers show that a surface selectively adsorbs components of a familiar but complex blend or odors. The adsorbed portion of the original blend is released at possibly higher concentration during off-cycles.

Each kind of surface exhibits a different ability to pick up odors and has a different preference for components. Surfaces also have different abilities to retain adsorbed odors. The best coil surface is one which sparingly picks up the more acceptable odor components and which releases them most readily to avoid build-up of foul odors.

Aluminum, tinned copper, and bare copper coils ranked in that order. Chromic and phosphoric acid dip treatments of aluminum gave the best odor performance of the large number of metals and coatings tested.

An inexpensive, rapid method of screening surfaces was developed and results were shown to correlate with those of coils tested in the laboratory. In turn, these findings were in good agreement with field observations.

Acknowledgments

The authors are grateful for the guidance and counsel of E. C. Crocker, S. E. Cairncross, L. B. Sjostrom and E. Kreidl of the Arthur D. Little, Inc., staff. The project could not have been carried out without the foresight and sponsorship of S. J. Levine and C. L. Fay, General Electric Air Conditioning Division.

APPENDIX

Derivation of Coil Quality Ratings

A simplified example will be used to illustrate in outline how panel observations are analyzed to predict odor performance of surfaces, and may also emphasize the mechanism of selective adsorption.

Suppose surfaces are exposed to an odor blend consisting of only three components. Further suppose that the panel agrees on the quality of the three odors, respectively, as *acceptable* (to nearly everyone), *doubtful* (depending on personal taste), and *unacceptable* (to nearly everyone). The panel is instructed not only to identify odors picked up by surfaces, but also to decide whether they are *weak* or *strong*. The two factors, quality and strength, combine to determine pickup ratings. The other half of the coil odor phenomenon depends on speed of desorption. Cooling coils tend to purge themselves during off-cycles. It can be seen that the faster this occurs the less the chances that accumulations will be carried over to *build-up*. Accordingly, the observers note the speed of purging when the samples are gently heated in a standardized way. Observations are recorded as *fast*, *moderate* and *slow* to provide the third factor needed.

The three factors can be combined 18 ways to form six coil quality ratings. Figs. A-1 to A-4, inclusive, show this graphically in four steps.

The 18 surfaces in Fig. A-1 start clean and have no odor. However, they are each different, having been chosen to cover exactly the range of possibilities in the simplified example.

The effect of quality of picked up odor is shown in Fig. A-2. It is necessary to suppose that each surface selectively adsorbs a single component. It is unlikely that any surface can retain a perfect rating by failing to adsorb any odor. Samples are demoted from the perfect rank according to quality of odor. Those having *acceptable* odors are demoted one rank on the basis that even these least obnoxious odors are not really desirable. *Doubtful* and *unacceptable* odors are respectively placed two and three places down from perfect.

In Fig. A-3, samples that adsorb strongly are demoted an additional rank, while those with weak pickup retain the places shown in Fig. A-2. This completes the pickup rating.

Samples with *fast* purging rates are allowed to keep their previous ranks as shown in Fig. A-4. Those with *moderate* rates go down one more rank, and those that are *slow* are demoted two places below the rank they had in the preceding figure. Predicted performance, or coil quality, now appears on six levels lower than *perfect*.

Determination of Acceptability Classifications

The foregoing example indicates the strong influence of odor quality, as compared to odor intensity, in predicting the suitability of a surface for cooling coil application. Field observations clearly support the decision to include odor quality as a prime factor in odor performance ratings. People actually prefer no odors in connection with air conditioning. They will, however, tolerate rather high levels of some odors while objecting strenuously to others that are barely discernible. There is a middle class of odors which some individuals can not tolerate, but to which others are relatively indifferent. It may be of interest to outline the method of classifying odor notes encountered in this investigation.

Each panel member was asked to list the odor notes in three groups on the basis of individual personal reactions. These listed as *acceptable* were felt by the individual to be tolerable (at moderate intensities) in any air-conditioned space; those called *unacceptable* would be intolerable anywhere, and the *doubtful* ones might be objectionable in one context but not in another. Lists were compared and a composite made up. Only unanimous choices remained in the *acceptable* column; all nominations for *unacceptable* were included in the composite, and the remainder were classed as *doubtful*.

A more objective method of measuring acceptability would be desirable. However, an opinion poll of a cross-section of the population is not practical, because each person polled would have to be exposed to the actual odors. A completely verbal

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method of determining odor opinion is not available.

Table A-1 is a record of the grouping used in this study and also indicates the nature and variety of the odor components observed on test strips exposed to cigarette smoke.

Table A-1—Classification of Odor Profile Notes[a]

Acceptable	Doubtful	Unacceptable
Cement	Burnt	Animal
Dusty	Coal Dust	Burnt Fragrance
Metallic	Fruity	Decayed Vegetable
Papery	Leathery	Earthy
Straw-like	Medicinal	Food-like
Sweet Fragrance	Painty	Footy
Woody	Seaweed	Pungent
	Soapy	Rubbery
	Solventy	Sour (B.O.)
	Sour	Sulfide
	Waxy	Tobacco

[a] The order of the notes in each column is alphabetical, rather than indicative of relative acceptability within the groups.

Reducing Actual Results to Coil Quality Ratings

The example shown graphically in Figs. A-1 to A-4 was purposely made simple by assuming that only one odor component be selectively adsorbed on each test strip. In the actual case several odor notes are adsorbed, and these may have different strengths and acceptabilities. Also, the speed of purging may be different for each component. However, the principle of successive demotions still applies and can be implemented arithmetically.

Figs. A-2, A3 and A-4, retaining the simplified example for the moment, can be expressed by the following equation:

$$\text{Coil Quality} = q + (s - 1) + (p - 1)$$

where

q = odor quality with values of 1, 2 and 3, respectively, for *acceptable, doubtful* and *unacceptable.*

s = odor strength with values of 1 and 2, respectively, for *weak* and *strong.*

p = purging rate with values of 1, 2 and 3, respectively, for *fast, moderate* and *slow.*

This equation will yield coil quality ratings from 1 to 6 (best to worst order) with maximum contributions of 3, 1 and 2, respectively, from odor quality, odor strength and purging rate.

In the case of several odor notes appearing on a test strip, coil quality for each note can be determined separately and averaged. Overall coil quality can be taken as the nearest whole number.

Decisions must be made before strength and purging rate can be reduced to numbers. The intensity scale used by the panel might be divided into weak and strong so as to include approximately half the cases encountered within each. Purging rate is indicated by the difference in intensity noted in the first observation after exposure and the final reading after purging. Similarly, this range might be divided into three.

The main point is that a systematic treatment of data is essential. An extensive investigation produces voluminous information that is difficult to reduce by intuitive methods.

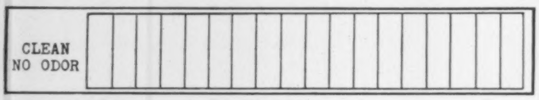

Fig. A-1—Eighteen different surfaces could theoretically be chosen to illustrate the full range of odor performance

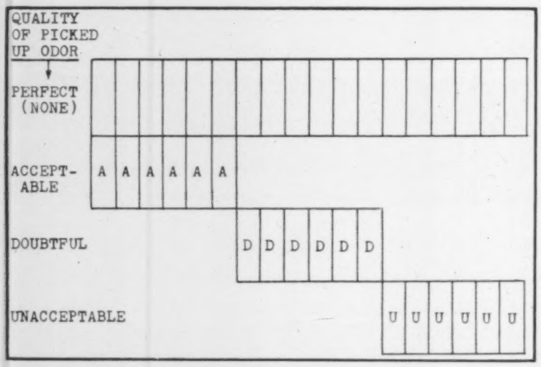

Fig. A-2—After exposure to a three-component blend, the surfaces divide themselves into three groups by selectively adsorbing a single odor component. The groups are respectively demoted one, two, and three places from *perfect* for picking up odors rated as *acceptable, doubtful,* and *unacceptable*

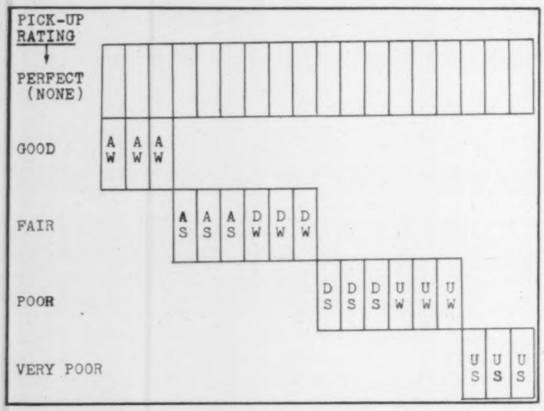

Fig. A-3—Pickup rating is completed by considering odor strength. Surfaces with weak (W) odor remain in place while those with strong (S) odor are demoted one additional rank

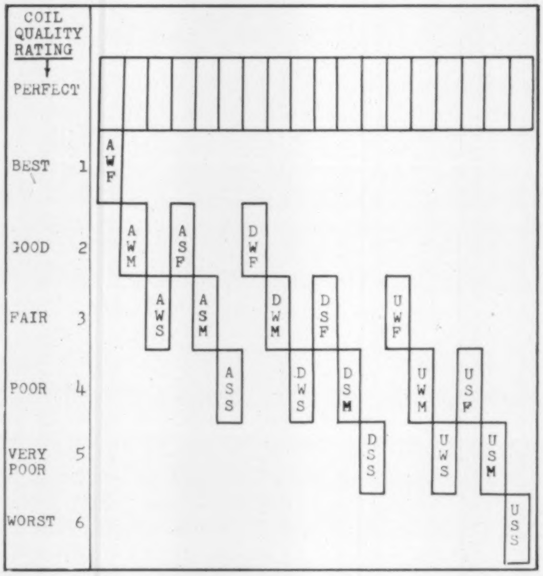

Fig. A-4—Odor performance in service is predicted by combining pickup ratings and purging ratings. The latter is judged by speed of desorption during heating and recorded at *fast* (F), *moderate* (M) or *slow* (S). Surfaces are demoted one additional place for moderate, and two for slow purging

Psychrometric Analysis for Design of Forced Draft Air Cooling Towers

By S. E. Agnon*, Haifa, Israel, and B. H. Spurlock, Jr.**, Boulder, Colo.

SUMMARY — Information on the performance of cooling towers is available but is of little practical use to the designer of a new tower. In this paper a method of design is developed that provides a quick and simple method for closely estimating the relevant data for any type of tower under any conditions. Although based on strict thermodynamic considerations, certain experimental relationships are introduced. The method also enables the operator to predict the probable performance, under conditions different from those for which the tower was originally designed.

The method is graphical and subject to the limitations of any graphical solution. Because of limitations and approximations, additional small differences may be introduced, but are of less importance than those errors incurred in the actual measuring of the physical properties of the fluids in the tower. As long as the final results are within the range of workable tolerances, any method of design is satisfactory and the simplest has the advantage of being less subject to error and needing less time.

THE COOLING process in a tower may be expressed with the aid of the psychrometric chart (Fig. 1). The chart is a combination of a humidity chart and an enthalpy diagram, both having a common abscissa divided into Fahrenheit degrees.

An important characteristic of the enthalpy part of the chart is that the scale of the ordinate divided into Btu is equal to the scale of the abscissa divided into Fahrenheit degrees. Since the abscissa may be considered to represent the heat content of the water (with specific heat of water equal to unity) and also since the abscissa has the same division as the ordinate, a direct geometrical and visual comparison between the enthalpies of air and water is possible. The *operating line* (to be taken up later) can be found by direct measurement, eliminating the necessity of tedious calculations.

The enthalpy may be closely represented[1] by

$$i_m = C_p\,T + 1061\,H + 10 \;\ldots\ldots(1)$$

where

i_m = enthalpy of air-vapor mixture, Btu per pound dry air.
T = air temperature, degrees Fahrenheit.
H = specific humidity, pounds of water per pound dry air.
C_p = specific heat of dry air at constant pressure, and at temperature T, Btu's per pound per Fahrenheit degree.

A simple way to find the enthalpy of the air mixture i_m is to locate the point on the psychrometric chart by means of the dry- and wet-bulb temperatures. Then follow the wet-bulb temperature line until the saturation line is reached, thence vertically upward until the enthalpy curve is reached. The value is read on the ordinate (Fig. 2, line A - a′ - a″ - a). In order to satisfy different barometric pressures, three separate curves are included in Fig. 1.

Any cooling or heating process between a dry surface and the air is represented by a horizontal line (Fig. 2, line A-B), whereas a cooling process as a result of heat transfer between the air and a wetted surface will lie on a straight line connecting the condition of the air initially (point A) and the saturation line at the temperature of the wetted surface (Fig. 2, line A-C, cooling, and line A-D, heating). This assumes that the surface is isothermal.

Any state or process shown on the humidity part of the chart can likewise be represented on the enthalpy part of the chart and vice versa. The enthalpy of the air-vapor mixture at (A) will, therefore, be represented on the enthalpy diagram by the point (a) on the same abscissa as the point (A). Similarly the straight line processes (A-B), (A-C), and (A-D) can be reproduced on the enthalpy diagram by (a-b), (a-c), and (a-d). For practical purposes these are straight lines.

The enthalpy difference between any two points (X) and (Y) of any process shown on the humidity chart (Fig. 2) can be expressed as:

$$\Delta i_m = i_{mx} - i_{my} = C_{pav}\,(T_x - T_y) + 1061\,(H_x - H_y) \;\ldots\ldots\ldots(2)$$

where C_{pav} is the mean value of the specific heat between T_x and T_y. Dividing Equation 2 by $(T_x - T_y)$,

$$(i_{mx} - i_{my})/(T_x - T_y) = C_{pav} + 1061\,(H_x - H_y)/(T_x - T_y) \;\ldots\ldots(3)$$

The term $(H_x - X_y)/(T_x - T_y)$, representing the slope of a straight line on the humidity chart drawn between the points (X) and (Y), is a fixed value and

$$(i_{mx} - i_{my})/(T_x - T_y),$$

being the expression for the slope of the process lines on the enthalpy chart is also fixed and the enthalpy process line on the chart as well as the process line on the humidity chart is a straight line between any two points (X) and (Y).

Tower Cooling Process

This is not the case for a process when the temperature of the surface is varying. Such an example is the cooling tower process. The cooling tower process may be represented by some curve such as (A-B) in Fig. 3, or its corresponding enthalpy curve (a-b).

In order to construct these curves it is necessary to review the funda-

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[1] Exponent numerals refer to References.

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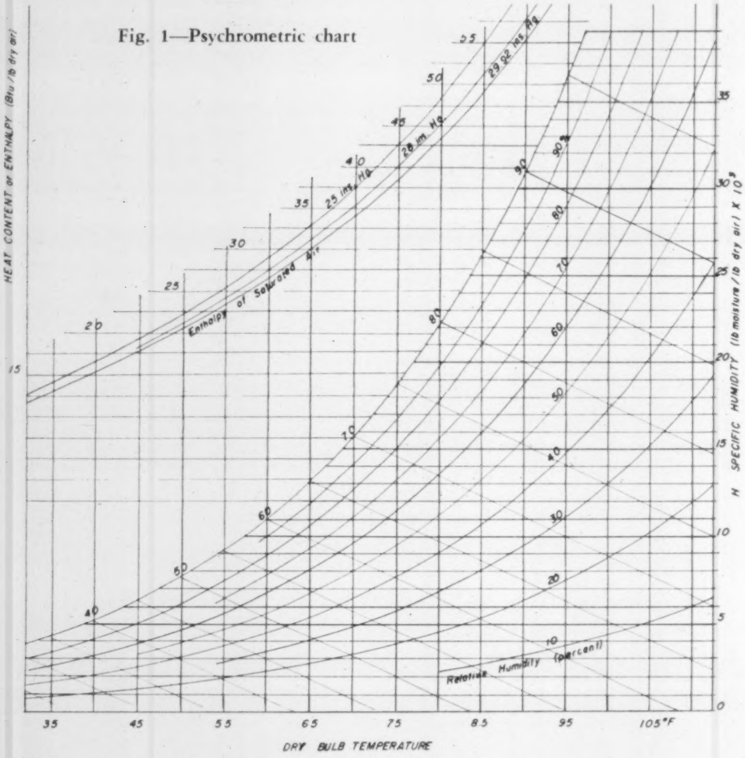
mental principles involved in the cooling tower.

A cooling tower is a chimney-like device (Fig. 4), where air and water are brought into contact, the air moving up or across the tower while the water falls by gravity. In the cooling tower, the problem is to cool water while in an evaporative cooler the air is cooled. The fundamentals are the same. During the cooling process not only is there a sensible heat exchange, but also a latent heat exchange in the water evaporated. It follows that the process must always proceed in the direction of an increase in humidity and will be accompanied by an increase in enthalpy of the air (not necessarily a rise in temperature). (If chilled water is sprayed into warm air the enthalpy of the air-vapor mixture might decrease.) The evaporative process establishes the temperature of adiabatic saturation (wet-bulb temperature lines, Fig. 3) as the lowest boundary of any such water cooling process and in general fixes the wet-bulb temperature as the theoretically lowest obtainable water temperature.

Fig. 1—Psychrometric chart



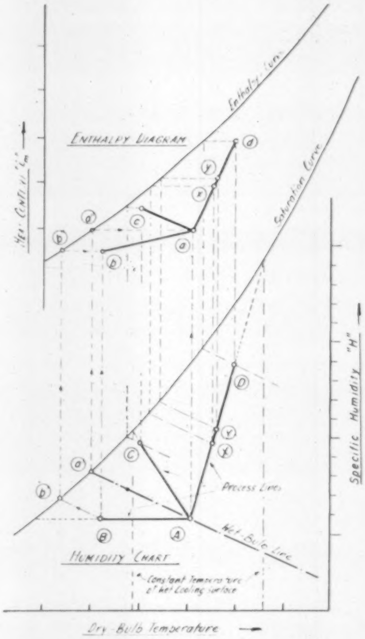


Fig. 2—Constant temperature cooling process

In contrast to the previously described process where the surface temperature is considered uniformly constant, both the air and the liquid surface temperatures vary.

At any instant, at any elevation in a vertical tower, the temperature may be assumed uniform and constant and the heat exchange, during this instant, will take place along a line connecting the supply condition (1) with a point (1′) on the saturation curve at the corresponding water temperature (see Fig. 3).

A little higher in the tower, an instant earlier in respect to the water stream and an instant later in respect to the air flow, the water temperature will be higher by a small amount, whereas the air condition will have moved from (1) a small distance along the line (1-1′) until it reaches point (2). The point fixing the condition of the air at (2) will move along the line (2-2′) until point (3) is reached, and so on.

It is evident that the curve of the cooling tower process or *conditioning curve* is the *envelope* of individual *net process* lines as just discussed. For construction purposes, the conditioning curve may be regarded as a succession of small individual straight lines (A-1), (1-2), (2-3), (3-4), and so on. Each of these individual elements has its corresponding counterpart in the enthalpy diagram, all of which together form a curved line illustrating the air enthalpy throughout the tower (see Fig. 3). This curve, called the *progress cooling curve*, shows clearly the principle of increasing enthalpy during the water cooling process. The progress cooling curve may be used in the same manner as the conditioning curve for calculations without the necessity of constructing the conditioning curve. In the Appendix* under *Mathematics of the Cooling Tower Process* it is shown that the conditioning curve as well as the humidity part of the chart is unnecessary and does not affect the accuracy of the method. However, as shown there, the slope of the operating line,

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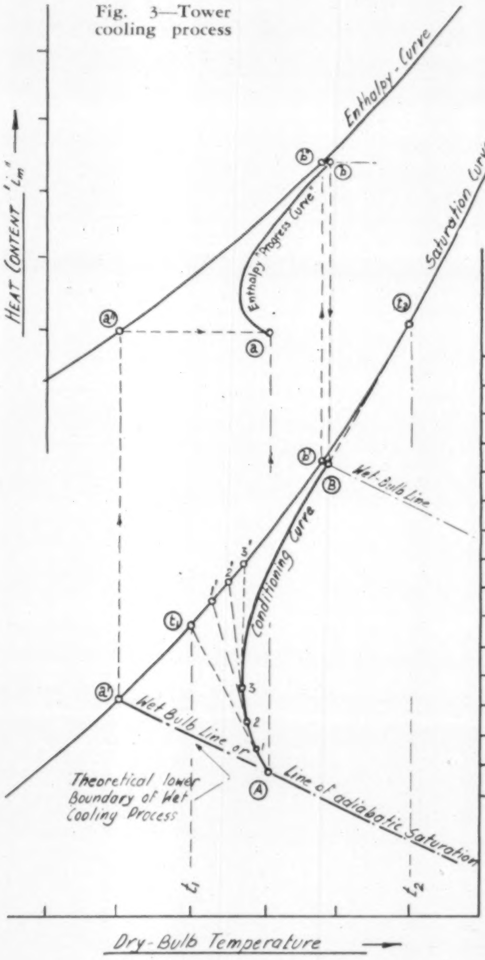
*The Appendix will be published in the 1955 TRANSACTIONS.

$$\tan\varphi = \Delta i_m/\Delta t = W/M \quad \ldots\ldots (4)$$

cannot be selected arbitrarily, but must be determined by considering the problem of cooling tower performance.



HEAT CONTENT 'i_m'
Enthalpy-Curve
Saturation Curve
"Enthalpy Progress Curve"
b"
b
a"
a
t2
b'
B
Wet-Bulb Line
Specific Humidity "H"
3'
2'
1'
Conditioning Curve
c
3
2
1
a'
Wet Bulb Line or Line of adiabatic Saturation
A
Theoretical lower Boundary of Wet Cooling Process
t1
t2
Dry-Bulb Temperature

Fig. 3—Tower cooling process

Cooling Tower Performance

As mentioned, the lowest water temperature that is theoretically obtainable coincides with the wet-bulb temperature of the entering air. In practice, temperatures a few degrees above the wet-bulb temperature are common and the difference is termed the *approach* (see Fig. 5). The smaller the approach the higher the thermal efficiency of the tower. The efficiency may be defined as

$$\eta_t = \text{Cooling range}/(\text{Cooling range} + \text{approach}) \quad \ldots\ldots (5)^\dagger$$

which, in Fig. 5 corresponds to

$$G - A' = \text{Cooling range}$$
$$G - a'' = \text{Cooling range} + \text{approach}$$

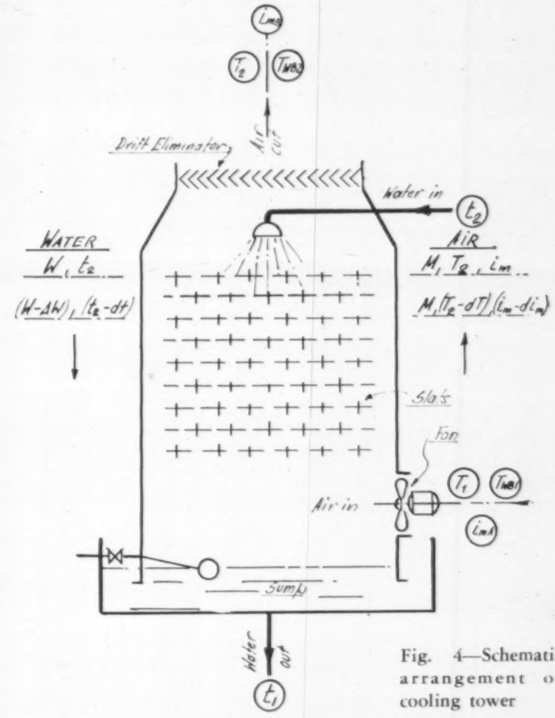
The numerical value of the approach depends on the design of the tower. A value of 5 to 6 deg Fahrenheit is the practical minimum, and it can be postulated that

$$t_1 \geqq \text{wet-bulb temperature} + 5\text{ F} \quad \ldots\ldots (6)$$

From Equation 4 it is evident that the slope ($\tan\varphi$) of the operating line and the water-air ratio (W/M) are dependent on each other. In order to keep the air requirements, the fan size and the power as small as possible, theoretically the operating line should be selected so that it passes through point (A′) and tangent to the enthalpy curve at (F) (Fig. 5). This would require an infinite tower height. A flatter line gives economical height but must be steep enough to keep the water-air ratio within practical limits and not reduce the mechanical efficiency of the tower too much. A distinction is made between the thermal efficiency η_t and the mechanical efficiency η_m. The mechanical efficiency is the ratio of the theoretical minimum amount of air M_t to the actual amount of air M required for the cooling process at the same thermal efficiency η_t. That is

$$\eta_m = (M_t/M) = (M_t/W)/(M/W) = \tan\varphi_t/\tan\varphi \quad \ldots\ldots (7)$$

where $\tan\varphi$ is the slope of the operating line for the actual cooling process and $\tan\varphi_t$ is the slope of the operating line for the infinite tower. (See Appendix under *Minimum Air at Infinite Tower Height*).



L_m2
T2
T_WB2
Drift Eliminator
Air out
Water in
t2
WATER
W, t2
(W-ΔW), (t2-dt)
AIR
M, T2, i_m
M, (T2-dT), (i_m-di_m)
Slats
Fan
T1
T_WB1
Air in
i_mA
Sump
Water out
t1

Fig. 4—Schematic arrangement of cooling tower

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†For considerations concerning the meaning and use of Equation 5 see Appendix under *Comments Concerning Equation 5*.

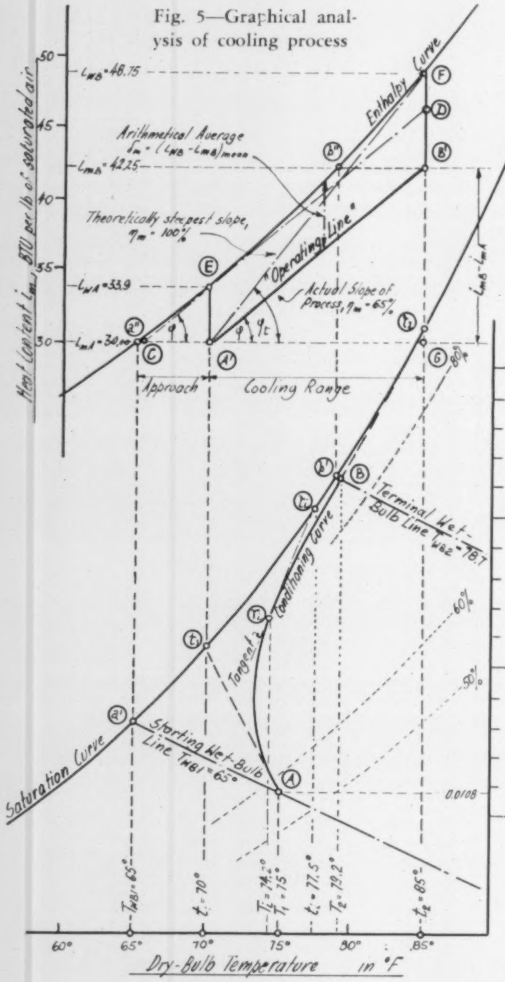
Fig. 5—Graphical analysis of cooling process
Heat Content i_m BTU per lb of saturated air
50
45
40
35
30
i_{WB} = 48.75
i_{mB} = 42.25
i_{WA} = 33.9
i_{mA} = 30.00
Enthalpy Curve
Arithmetical Average $\delta_m = (i_{WB} - i_{mB})_{mean}$
Theoretically steepest slope, η_m = 100%
"Operating Line"
Actual Slope of Process, η_m = 65%
$i_{mB} - i_{mA}$
F
D
B'
b''
E
a''
C
A'
G
t_2
φ
φ_t
Approach
Cooling Range
Specific Humidity "H"
0.025
0.020
0.015
0.0108
0.010
80%
60%
50%
b'
B
T_2
Terminal Wet-Bulb Line T_{WB2} = 78.7
Conditioning Curve
T_i
Tangent
t_1
a'
Starting Wet-Bulb Line T_{WB1} = 65°
A
Saturation Curve
T_{WB1} = 65°
t_1 = 70°
T_i = 74.2°
T_1 = 75°
t_i = 77.5°
T_2 = 79.2°
t_2 = 85°
60°
65°
70°
75°
80°
85°
Dry-Bulb Temperature in °F

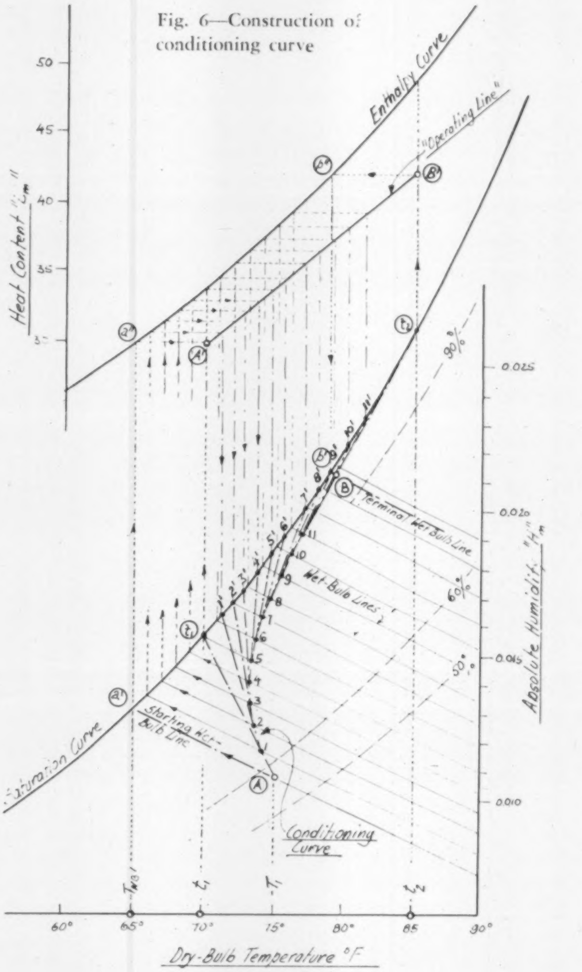
Fig. 6—Construction of conditioning curve
Heat Content "i_m"
50
45
40
35
30
Enthalpy Curve
"Operating Line"
b''
B'
a''
A'
t_2
90%
60%
50%
0.025
0.020
0.015
0.010
Absolute Humidity "H"
b'
B
Terminal Wet-Bulb Line
Wet-Bulb Lines
1' 2' 3' 4' 5' 6' 7' 8' 9' 10' 11'
1 2 3 4 5 6 7 8 9 10 11
t_1
a'
Starting Wet-Bulb Line
Saturation Curve
A
Conditioning Curve
T_{WB1}
t_1
T_1
t_2
60°
65°
70°
75°
80°
85
90°
Dry-Bulb Temperature °F

The mechanical efficiency η_m is influenced by the tower design, and in addition to some extent by the thermal efficiency η_t. When determining the angle φ, McAdams[2] points out that the mechanical efficiency η_m should not exceed 75 percent, as with already high values of η_t any small increase in η_m will require an excessively large increase in tower height, without a corresponding gain in η_t (see Fig. 11).

In most cases the mechanical efficiency

$$\eta_m = \tan \varphi / \tan \varphi_t$$

can be measured directly by the length ratio $(B' - G)/(F - G)$ as is evident from Fig. 5. However, caution must be employed, not to do so indiscriminately as will be seen in the extreme case demonstrated by Fig. 9. In this case (Fig. 9) the mechanical efficiency must be expressed by means of Equation 7, and is $(B' - G)/(f - G)$. The reason for the difference in the expression is due to the fact that the tangent point in the latter case (Fig. 9) is at a lower temperature than t_2 and not coincident with or higher as for most cases.

The range of the water-air ratios is, therefore, dependent on the tower design and this must be taken into consideration when selecting the slope. In practice the tan φ can assume any value between 0.6 and 1.40. In the majority of cases, the value may be assumed between 0.9 and 1.1. For a rough approximation and an average value of tan φ, a value equal to unity may be assumed conforming to a slope angle of 45 deg.

Having fixed the terminal conditions of the cooling process and selected the slope of the operating line, it becomes possible to determine more-or-less accurately, the condition curve as shown in the following problem.

Problem: A cooling tower is to be designed to cool 120 gpm of water over a temperature range of 15 F to the lowest obtainable temperature.

Outside air conditions are T_1 equal to 75 F, and Twb_1 equal to 65 F, corresponding to a relative humidity of approximately 57 percent. The mechanical efficiency of the tower is assumed to be 65 percent and the approach is 5 F.

Draw the conditioning curve, estimate the amount of air required for cooling and calculate the thermal efficiency. Find the temperature T_2, as well as the wet-bulb temperature Twb_2 of the air at the top of the tower and determine the temperature T_1 of the air at a point in the tower, where the water has been cooled by half of the temperature range.

Solution: (See Figs. 5 and 6, where Fig. 6 is a detail of Fig. 5)

The lowest obtainable temperature of the water at the bottom of the tower is according to Equation (6)

$$t_1 = T_{wb1} + 5 = 65 + 5 = 70 \text{ F}$$

Since the cooling range is 15 F, then the water must enter the top of the tower at 85 F. The thermal efficiency is according to Equation (5):

$$\eta_t = \text{Cooling range}/(\text{Cooling range} + \text{approach}) = 15/(15 + 5) = 0.75$$

To construct the conditioning curve it is necessary to draw the operating line. Fix the point (A) on the humidity chart (Fig. 5) from the given data. Follow the constant wet-bulb temperature line to the saturation line (point a′), then vertically upwards to the enthalpy line (point a″) and horizontally to the right until it intersects the temperature t_1 (point A′). This is the point (A) on the humidity chart reproduced on the enthalpy chart. Now draw a straight line through (A′) to the point (F) where the initial water temperature (t_2) crosses the enthalpy curve. By measurement the slope of (F-A′) is

$$\tan \varphi_t = 1.28.$$

Then from Equation 7, the slope of the operating line is

$$\tan \varphi = \eta_m \tan \varphi_t = 0.65 \times 1.28 = 0.835$$

The operating line is constructed with a slope

$$\varphi = \tan^{-1} 0.835 = 40 \text{ deg};$$

through point (A′) until it intersects the temperature t_2 at the point (B′). The operating line is now known and the conditioning curve may be constructed.

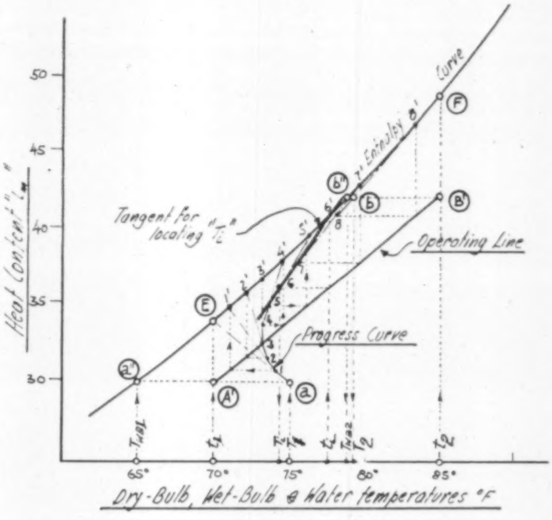

Fig. 7—Construction of progress curve

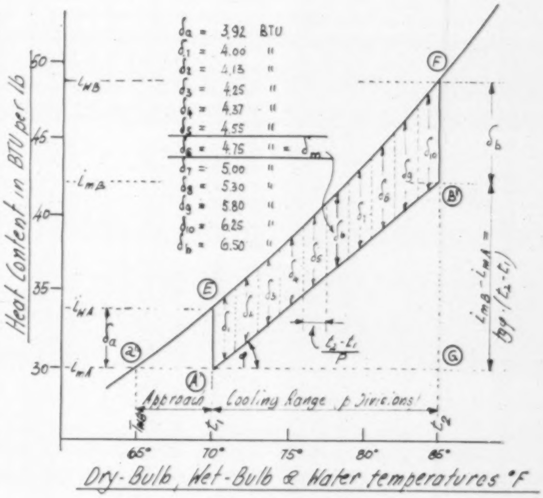

Fig. 8—Calculation of tower height

Draw a straight line from point (A) (refer to Fig. 6 for detail) to the point t_1 on the saturation curve. Select a point (1) on the line (A — t_1), a small distance from (A). Proceed from (1) parallel to a constant wet-bulb temperature line to the saturation curve, thence vertically to the enthalpy curve, then to the right to the operating line and vertically downwards to the saturation curve. This fixes the point (1′). Draw a line from (1) to (1′). On this line (1 — 1′) close to (1) select a point (2) and repeat the same procedure as before locating the point (2′). This method is followed until the temperature t_2, the initial temperature of the entering water, is reached.

To find the terminal conditions of the air, simply reverse the above method. Starting at (B′) on the enthalpy chart, proceed horizontally to the left to (b″), thence downwards to (b′) and along a constant wet-bulb temperature line to the point (B) on the conditioning curve. This gives the conditions for the outgoing air to be 79.2 F for dry-bulb temperature and 78.7 F for wet-bulb temperature (Fig. 5).

The curve enveloping the individual points (A, 1, 2, 3, 4, etc.) represents the conditioning curve and illustrates the path of the cooling process. The smaller the elements, the more exact are the results.

In order to find any two corresponding temperatures of air and water during the process it is necessary only to draw a tangent to the conditioning curve. The point of tangency represents the air temperature T_1, the intercept at the saturation curve indicates the water temperature t_1 (Fig. 5). The water temperature t_1 at half the cooling range is

$$t_1 = (85 + 70)/2 = 77.5 \text{ F}$$

From the point t_1 equal to 77.5 on the saturation line a line is drawn tangent to the conditioning curve. This is the temperature T_1 equal to 74.2 F corresponding to the air conditions in the tower where the water temperature is 77.5 F.

The amount of water to be cooled is 120 gpm or 1,000 lb per min. Therefore the amount of air required for cooling is by Equation 4

$$M = W/\tan \varphi = 1000/0.835 = 1200 \text{ lb per min, and}$$

$$(1200 \text{ lb/min})/(0.075 \text{ lb/ft}^3) = 16{,}000 \text{ ft}^3\text{/min standard air}$$

The same results could have been obtained by means of the progress curve. The construction of this curve is similar, but actually it is simpler than that of the conditioning curve.

Locate points (A′) and (a) as indicated previously. Keeping in mind that every process line of the humidity chart has its counterpart on the enthalpy chart, draw a line (a-E) (See Fig. 7), corresponding to (A-t_1) on Fig. 6. Now select a point (1) on the line (a-E) close to (a), proceed horizontally to the operating line, then upwards to the enthalpy curve at point (1′). Connect point (1) and (1′). Choose point (2) close to point (1) on the line (1-1′) and go through the same process as before, locating point (2′). Continue until the progress curve is completed.

To find the intermediate temperature T_1, the method is exactly the same as with the conditioning curve.

Tower Height and Area

The principal value of the operating line lies in its importance for estimating the height of the cooling tower. It was shown in a previous paper[3] that the *overall driving* *force* or *potential* at any point in the tower may be represented by

$$-\delta = (i_w - i_m),$$

which is the enthalpy of the saturated air minus the enthalpy of the air at the same temperature. This is the vertical distance between the operating line and the enthalpy curve.

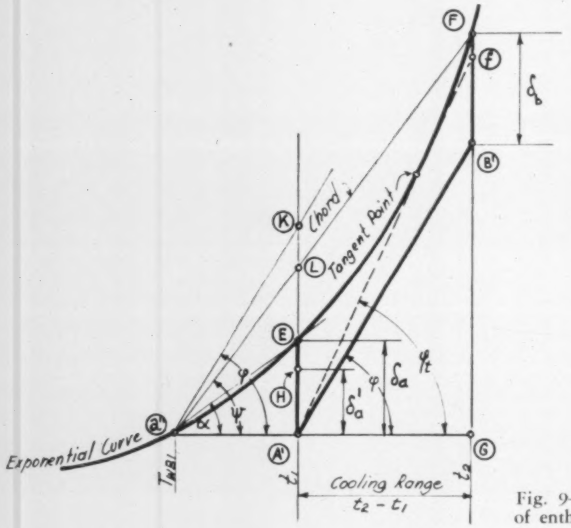

Fig. 9—Geometrical relations (curvature of enthalpy curve is greatly exaggerated)

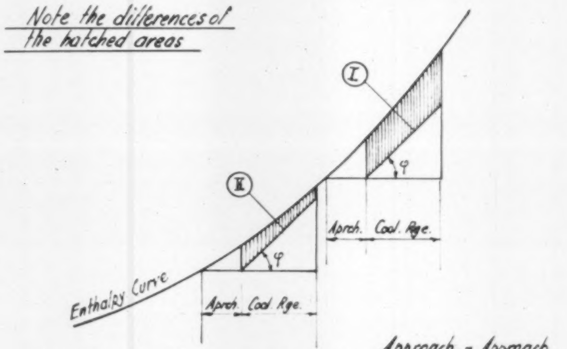
Note the differences of the hatched areas
I
II
φ
Aproch. Cool. Rge.
Aproch. Cool. Rge.
Enthalpy Curve
$\frac{\text{Approach}_I}{\text{Cool. Rge.}_I} = \frac{\text{Approach}_{II}}{\text{Cool. Rge.}_{II}}$
$\varphi_I = \varphi_{II}$

Fig. 10—Operation under changing conditions (curvature of enthalpy curve is greatly exaggerated)

If a line is drawn through point (A′) and tangent to the enthalpy curve at point (F) Fig. 5, it is noted that the potential difference becomes smaller towards the top of the tower and in this case (infinite tower) would approach zero as a limit. As was indicated, smaller values of φ must be selected for economical reasons.

The tower height can be expressed as a function of the area (A′-E-F-B′) in Fig. 5. If Z_{og} is called the *height of a mass transfer unit*, then the total effective height of the cooling tower can be found by the equation

$$Z = Z_{og} \int_{i_{mA}}^{i_{mB}} \frac{di_m}{i_w - i_m} = N \cdot Z_{og} \cdots\cdots\cdots (8)$$

where

$$N = \int_{i_{mA}}^{i_{mB}} \frac{di_m}{i_w - i_m},$$

and is called the number of *mass transfer units.*

The value of Z_{og} for use in Equation 8 is a function of (m/Ka), where m is the mass velocity of the air measured in lb per min per sq ft and Ka expresses the *overall mass transfer coefficient* in the same units for a specific type of tower packing. The values of Ka are a function of both the water velocity and the air velocity. In some cases higher flow rates require higher towers, in others, the reverse. Experimental values of Z_{og} are available in the literature.

In Table 1 representative data are given for various types of tower packing. The data indicate the average value of Z_{og} over their range of validity.

Table 1—Data for forced draft Cooling Towers

Type of Tower Packing	Z_{og}, ft	Mass velocity of air; m = lb/sq ft min	Mass velocity of water; w = lb/sq ft min
Vertical Spray Tower[a]	10 — 2.5	7	3.3 — 10
Vertical Spray Tower[a]	4.7	5 — 12	7
Grid Packing[a]	14.4	9.2	12
Grid Packing[a]	19	17 — 38	53
Spinded tubing, horizontal staggered[a]	3.5 — 3.9	7.2 — 12.7	11.7
Raschig Rings, 15 mm[b]	1 — 0.9	7.5 — 15[c]	[d]
Streamlined Wood Sections, 2.3/4 in. long[b]	5 — 7	9.5 — 17[c]	[d]

[a] Reference 2, p. 290.

[b] HEATING, VENTILATING, AIR-CONDITIONING GUIDE 1947, p. 670.

[c] These mass velocities refer to the free (not the *gross*) area in the tower.

[d] Complete wetting of the packing surfaces is supposed.

With values of Z_{og} thus available, the remaining part of solving Equation 8 consists of finding ways of arriving at the value of N. There are several possible methods of procedure.

One of these is by a step-wise, or graphical, integration of Equation 8. Equations for such a solution are developed in the Appendix under the heading *Graphical Integration of Equation 8* and by means of an example this method is illustrated.

Another method is also described and illustrated in the Appendix† which permits a somewhat more rapid procedure in making the calculations. This method is based on the equation:

$$\begin{aligned} N = {} & \eta_m/2\,[1/(1 - \eta_t) \\ & + 1/(1 - \eta_m)] \\ & + 0.12\,[\eta_m\,\eta_t \tan \varphi / \\ & (1 - \eta_m)\,(1 - \eta_t)] \ldots\ldots (9) \end{aligned}$$

The Nomograph (Fig. 11) for Design

None of the methods of evaluating N just mentioned is wholly simple and consequently it seems desirable to work out a graphical means of making this solution by the use of a straight edge and a minimum of computations.

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†Under the heading *Development and Use of Equation 9.*

To construct a chart for this purpose Equation 9 is plotted in the form of an alignment chart along with a second alignment chart expressing tan φ in terms of known basic data, *viz*:

$$\tan\varphi = \frac{\eta_m}{\eta_t} \cdot e^{\left(\frac{T_{WB}}{40}+1.75\right)} \left[\frac{e^{\left(\frac{t_2-T_{WB}}{40}\right)}-1}{t_2-T_{WB}}\right] \quad \text{(10)*}$$

The result of this plotting is the chart of Fig. 11.

Two barometric pressures (29.92 and 25.0 in. Hg) have been provided on Fig. 11. One may interpolate between these two pressures with the only error involved at this point. Comparison of the two scales shows that a falling barometer has the same effect as increasing the wet-bulb temperature with constant barometer and vice versa. For example, the 65 F at 29.92 in. Hg corresponds to 61.3 F at a barometer of 25 in. Hg.

Problem: As an example of the use of the chart, let us solve for N when tan φ = 0.835 and W = 1000 lb of air per min, and when the mechanical efficiency (η_m) is 0.65 and the thermal efficiency (η_t) is 0.75.

The solution is made with Fig. 11 by locating 0.835 on the right-hand scale. Then locate the intersection of the (η_m) = 0.65 line with the (η_t) = 0.75 line. Lay a straight edge between these two points and read N on the extension of this line to the left-hand scale, as N = 2.8.

In the Appendix this same problem was solved by graphical integration of Equation 8 and produced a value of N = 2.64. There also, Equation 9 was used to solve this same problem and N was found to be 2.78. It can thus be seen that the use of Fig. 11 results in a solution for N with values not greatly different from those found by the longer and more tedious methods.

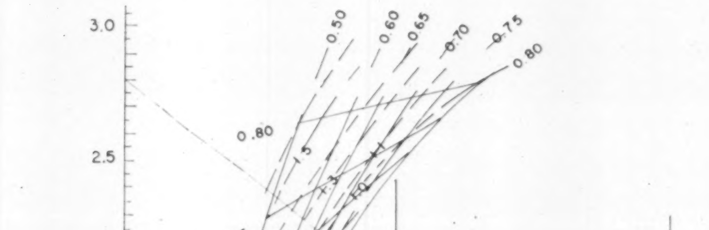

Fig. 11—Nomograph for determination of cooling tower design data. Forced draft type. Network of lines on efficiency grid as on Fig. 12.

Operation Under Changing Sets of Conditions

Often a cooling tower will have to be operated under conditions different from those for which it was designed. In the absence of performance data the problem of estimating the comparable performance is not easy, even by means of the detailed graphical analysis. However, the nomograph Fig. 11 handles this problem readily.

To demonstrate the difficulties encountered, consider a tower operating with a varying wet-bulb temperature. It will be remembered that the cooling process depends on the position, length and slope of the operating line, while the height of the tower is determined by the *shape* of the *area of the driving forces*. Let the process (I) in Fig. 10 represent such a process and (II) represent the process after the wet-bulb temperature has been changed. It is seen that if the operating data is maintained, a modification takes place in the shape of the *area of the driving forces*, involving a higher mechanical efficiency and a greater number N.

For an existing tower, this is obviously impossible, the number N being fixed and the same irrespective of temperature conditions‡, consequently some of the operating data must change in order to give the same tower height. The nomograph eliminates extensive *trial and error* calculations and the time spent is appreciably reduced. The following typical problem illustrates the use of (Fig. 11).

---

*For the mathematical analysis leading to Equation 10 see the Appendix under *Development of Equation* 10.

‡This statement is valid only in the case of constant air-water flow rate. For certain types of towers the height of the mass transfer unit Z_{og} is a function of the flow rates (See Table 1), so that in such a case the number N cannot be assumed constant under all circumstances. However within the range of flow variations caused by weather variations, the number N may be assumed constant.

Journal Section

Problem: The following data are obtained from a cooling tower; wet-bulb temperature 55 F, rate of water flow 528 gpm, inlet temperature of water 95 F, outlet temperature of water 70 F, air flow rate 4,000 lb. per min (53,400 cfm standard air).

If the wet-bulb temperature is changed to 60 F and the tower performance is to remain the same, what modification in the tower is necessary? (Note: Tower inlet temperature of the water t_2 is to remain the same).

Solution: The first step towards solving the problem consists of finding the number *N* of mass transfer units of the tower by means of Fig. 11. For this purpose begin by computing η_t and tan φ.

From equations (5) and (4)

$$\eta_t = (t_2 - t_1)/(t_2 - T_{WB})$$
$$= (95\text{-}70)/(95\text{-}55) = 25/40 = 0.6$$

and

$$\tan \varphi = W/M = (528 \times 8.33)/4000$$
$$= 1.1$$

On Fig. 12, with a wet-bulb depression (cooling range plus approach) of 40 F and a water to air ratio of 1.1, draw the lines 1-2-3-5. The ratio

$$\eta_m/\eta_t = 1.10$$

is obtained, from which

$$\eta_m = 1.1 \times 0.6 = 0.66.$$

From

$$\eta_m = 0.66,\ \eta_t = 0.60$$

and point (5) by means of a straight edge point (7) is located and

$$N = 2.2.$$

This is the number of mass transfer units which remains constant for the tower.

The following steps are almost the reverse of the foregoing, but with a different wet-bulb temperature. Raising the wet-bulb temperature to 60 F and keeping the temperature of the inlet water t_2 at 95 F will cause a reduction in the approach, thereby raising the thermal efficiency.

Through the wet-bulb temperature 60 F and the wet-bulb depression (cooling range plus approach) of 35 F extend the line to point (3′) (Fig. 12). Connecting this point (3′) with the previous water to air ratio

$$W/M = \tan \varphi = 1.10, \text{ (lines 1′-2′-3′-5), thereby giving}$$

$$\eta_m/\eta_t = 1.05, \text{ at the point } (4_1).$$

Using the line (5-7) locate the point (6_1) on the line

$$\eta_m/\eta_t = 1.05.$$

This corresponds to values of

$$\eta_m = 0.65, \text{ and}$$
$$\eta_t = 0.62$$

The cooling range is equal to

$$\eta_t \times (t_2 - T_{wb}) = 0.62\ (95 - 60)$$
$$= 21.7 \text{ F}$$

as compared to 25 F, even though the thermal efficiency has increased from 60 to 62 percent.

In order to handle the same heat load as before, the amount of water circulated will have to be increased as well as the air rate to maintain the constant water-air ratio assumed. The increase in rate of flow of the two fluids is (25 − 21.7)/21.7 = 0.15, and the pump and fan will have to be modified accordingly.

It is perhaps more desirable to maintain the water rate constant and change the air rate to accommodate this. This step consists of keeping the cooling range at 25 F and modifying the water-air ratio (tan φ).

In this case

$$\eta_t = 25/35 = 0.715$$

The point (5′) indicating the new value of tan φ will be found by *trial* and must be so located that the line (3′-5′) and the η_m/η_t line (bottom of chart, Fig. 12) will give the same efficiency ratio as the (5′-7) line (top of chart, Fig. 12). The points so located show that (4′) and (6′)

$$\eta_m/\eta_t = 0.835$$

and

$$\tan \varphi = W/M = 0.875^*$$

In order to keep the rate of water circulated constant, it will be necessary to increase the air flow rate by

$$(1.1 - 0.875)/0.875 = 0.257 \text{ or } 25.7 \text{ percent}$$

above the original rate. This will be simpler and more economical to operate under changing weather conditions. Instead of increasing the pump and fan capacities by 15 percent, simply increase the air flow rate by 25.7 percent.††

References

1. *Air Conditioning Analysis*, by William Goodman (The Macmillan Co., New York, N.Y., 1943).

2. *Heat Transmission*, by W. H. McAdams (McGraw-Hill Book Co. Inc., New York, N.Y., 1942, p. 228).

3. Performance of a Forced-Draft Cooling Tower, by B. H. Spurlock, Jr. (ASHVE TRANSACTIONS, Vol. 59, 1953, p. 311).

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*It will not always be possible to locate common values on the η_m/η_t scale and in the grid. This indicates that the tower will not give the required performance without changing the cooling range and the amount of water circulated.

††The example demonstrates the influence of changing wet-bulb temperature on the performance of the tower for a constant inlet water temperature. This should not be confused with the case shown in Fig. 10, where the temperature of the inlet water varies in the same amount as the wet-bulb temperature. The results obtained in the former case are exactly opposite to those in the latter, which corresponds to that of different barometric pressures.

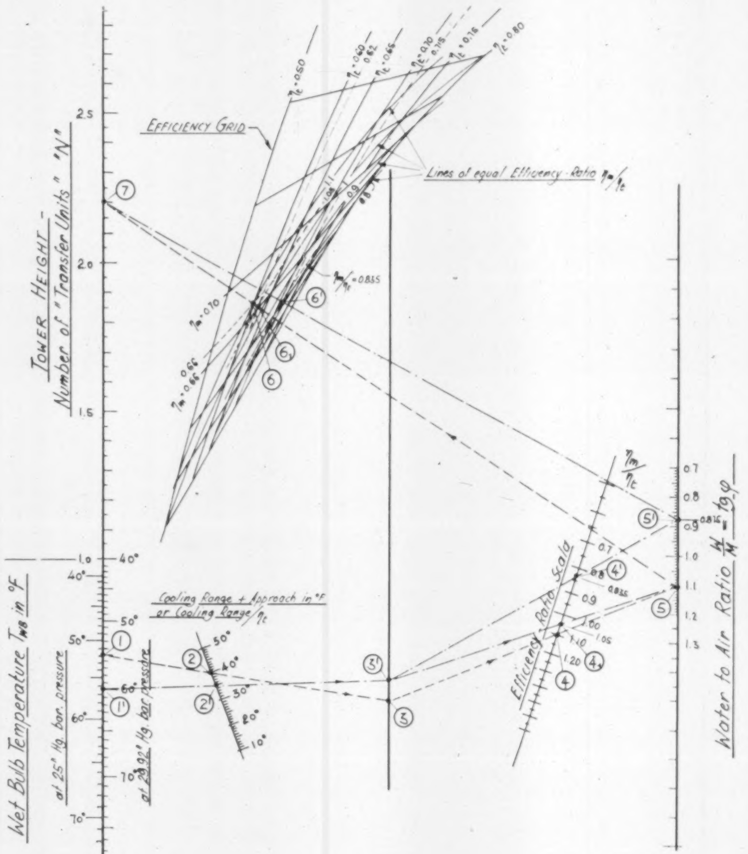
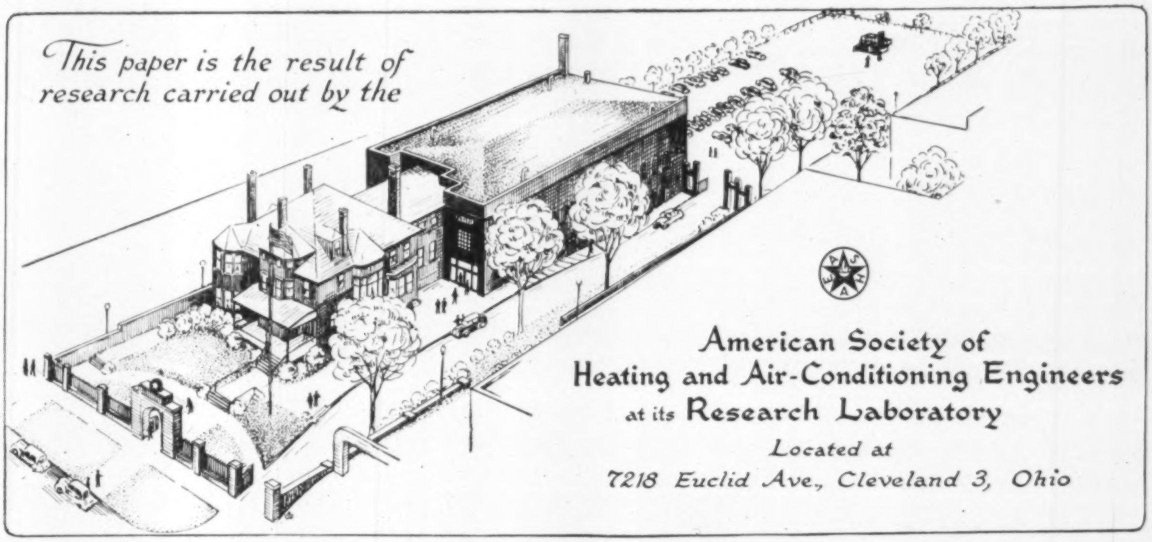

TOWER HEIGHT - Number of "Transfer Units" "N"
2.5
2.0
1.5
1.0
EFFICIENCY GRID
η_t = 0.50
η_t = 0.60
0.62
η_t = 0.65
η_t = 0.70
0.715
η_t = 0.76
η_t = 0.80
η_m = 0.70
η_m = 0.66
0.65
1.1
1.05
0.9
0.8
Lines of equal Efficiency-Ratio η_m/η_t
η_m/η_t = 0.835
7
6′
6_1
6
Wet Bulb Temperature T_{WB} in °F
at 25" Hg. bar. pressure
at 29.92" Hg. bar. pressure
40°
50°
60°
70°
Cooling Range + Approach in °F or Cooling Range/η_t
50°
40°
30°
20°
10°
1
1′
2
2′
3′
3
Efficiency Ratio Scale
η_m/η_t
0.7
0.8
0.835
0.9
1.00
1.05
1.10
1.20
4′
4_1
4
5′
5
0.7
0.8
0.9
0.875
1.0
1.1
1.2
1.3
Water to Air Ratio W/M = tg φ

Fig. 12—Skeleton nomograph showing solution of problem of operating conditions different from design conditions


This paper is the result of research carried out by the
American Society of Heating and Air-Conditioning Engineers at its Research Laboratory
Located at 7218 Euclid Ave., Cleveland 3, Ohio

Periodic Heat Flow Through Flat Roofs

By D. J. Vild*, Cleveland, Ohio, M. L. Erickson**, Minneapolis, Minn., G. V. Parmelee† and A. N. Cerny‡, Cleveland, Ohio

SUMMARY — Time lags and rates of heat flow are shown for a typical three-layer roof section. Comparison of test results with exact mathematical solutions are made. Included is an analysis of the limitations of assumptions made in the mathematical solutions. Reversing the order of materials is shown to have a significant effect on the thermal behavior of the roof.

For many years engineers have been faced with the difficulty of properly evaluating the portion of the cooling load due to periodic heat flow through multi-layer building sections. One example of considerable importance is estimating heat gain through roofs of large single-story buildings, such as shopping centers, schools and industrial plants. An analytical solution to the problem was developed in 1946 by C. O. Mackey and L. T. Wright, Jr.[1] of Cornell University. Their solution stated exact equations for idealized conditions of heat flow and included a number of assumptions intended to simplify, as far as possible, a complex mathematical calculation. To obtain a comparison between the thermal behavior of a structure under natural weather conditions and the behavior predicted by the Mackey-Wright equations, and to determine the limitations of their assumptions, a research program was initiated at the ASHAE Research Laboratory by the Technical Advisory Committee on Cooling Load.□

The building section chosen was a roof constructed of three homogeneous layers typical of many used today in commercial buildings. Tests were run with the test section exposed to the weather on one side and to a constant temperature space on the other.

This paper presents the results of these tests and compares rates of heat gain and time lags with predicted values based upon the Mackey-Wright equations for multi-layer construction.

Description of Test Apparatus

The test apparatus was the solar calorimeter used in the research on heat flow through glass and described in Reference 2. In the roof tests, it was not used as a calorimeter, but as a constant temperature heat sink. Heat flow at both roof surfaces was measured by heat-flow meters as described later. The heat sink was maintained at a constant temperature by means of a refrigerating unit and thermostatically-controlled electric heaters. Fig. 1 is a schematic sketch of the calorimeter and the test section.

Construction and Instrumentation of Roof Section

The test section was approximately 4 ft sq and mounted in a wooden frame that would fit into the opening in the test apparatus. It consisted of a layer of four-ply felt roofing, 2 in. of vegetable-fiber insulation board, and 3 in. of sand-and-limestone-aggregate concrete. As the section was to be tested with the concrete side both in and out, a single ply of felt roofing was cemented on the indoor side to provide surfaces of the same emissivity and solar absorptivity on both sides of the section.

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†Senior Research Supervisor, ASHAE Research Laboratory, Member of ASHAE.

‡Research Mathematician, ASHAE Research Laboratory.

[1] Exponent numerals refer to References.

Presented at the Semi-Annual Meeting of the American Society of Heating and Air-Conditioning Engineers, San Francisco, Calif., June 1955.

□Personnel: C. O. Mackey, Chairman; R. C. Jordan, Vice Chairman; K. O. Alexander, John Everetts, Jr., H. T. Gilkey, R. H. Heilman, H. W. Heisterkamp, A. J. Hess, A. T. Jorn, C. F. Kayan, J. N. Livermore, P. E. McNall, Jr., I. A. Naman, H. B. Nottage, C. P. Roberts, J. P. Stewart, H. B. Vincent, T. N. Willcox, W. E. Zieber.

Care was taken in construction of the test section to assure no air blisters between the layers of the roof. The bonding materials used were a quick-setting, rubber-base adhesive and a high-melting-point asphalt.

Temperatures of each surface and each interface of the roof section were measured by sets of 14 copper-constantan thermocouples; six were placed diagonally in the center or *test area* of the roof and eight were placed in the outer or *guard area*. The *guard area* was 8 in. wide, sufficient to insure one-dimensional heat flow through the *test area*. (Temperature readings during the tests proved this to be so.) The surface thermocouples were imbedded slightly in the asphalt surface.

Heat flow was measured by means of four heat-flow meters placed on each surface within the *test area*. These heat-flow meters were the type[3] developed at the ASHAE Research Laboratory. They were bonded to the surfaces of the roof with asphalt and then covered with the same material to provide a surface having the same emissivity and solar absorptivity as the rest of the roof.

Switches were so wired that temperatures across the *test area* could be read individually or in parallel; temperatures in the *guard area* were read individually. The outside heat-flow meters were read individually or in parallel, and the inside heat-flow meters individually or in series. This arrangement made it convenient to check temperatures and heat flows against each other while tests were in progress.

Other Instrumentation

Solar radiation measurements were made with three Eppley multi-junction pyrheliometers. All were mounted horizontally, two adjacent to the roof and the third on a nearby tower. One pyrheliometer adjacent to the roof measured total radiation and, by means of a shading device, the other measured diffuse radiation. The third could check either of the other two.

A shielded, aspirated thermocouple was used to measure outdoor dry-bulb temperature. Also, at regular intervals, outdoor dry-bulb and wet-bulb temperatures were taken with an aspirated psychrometer.

Low-temperature outdoor radiation measurements were made with a convection-compensated radiometer developed at the ASHAE Laboratory and described in Reference 4.

Wind velocity was measured with a cup-type anemometer and wind direction by a wind vane. General sky conditions were also noted.

The outputs of the thermocouples, heat flow meters, and pyrheliometers were read on an electronic, self-balancing potentiometer. In addition, a record was made on the 16-point high-speed recorder of the following: (*a*) temperatures of the outside roof surface, (*b*) temperatures of the inside roof surface, (*c*) temperatures of the heat-sink surface, (*d*) heat flowing at the inside and outside surface, (*e*) amount of total solar radiation, and (*f*) amount of diffuse solar radiation. The recorder also provided a continuous record of those values most subject to fluctuations, making it possible to average them.

Calibration of Heat Flow Meters

A number of heat-flow meters were calibrated on a cooled plate by means of the portable calibrator described in Reference 3. From this number, groups of four were selected which had calibration constants within 10 percent of each other. The meters were then re-calibrated with the portable calibrator after they were cemented in place on the roof section.

Physical Properties

It was important that the physical values of the materials used in the roof section be accurately ascertained to provide a valid comparison between calculated and observed results. The importance of each value cannot be determined without lengthy and involved calculations. However, particular attention was paid to obtaining accurate conductance values, since they are most subject to variations.

To check the conductances of the various materials, conductance tests were run while the roof was in place in the test apparatus. An aluminum foil container large enough to cover the entire roof surface was put in place and filled with crushed ice. The calorimeter surface (normally the heat sink) was kept at a constant elevated temperature. From the heat flows and the temperatures of the interfaces and surfaces of the test section observed under equilibrium conditions, the overall conductance and the conductance of each layer were computed. These values, except for the concrete, agreed very well with handbook values.

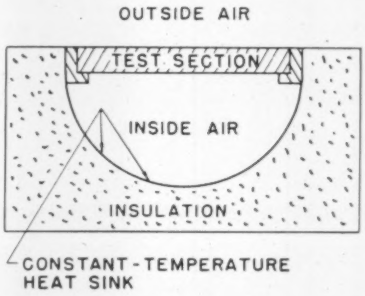


Fig. 1—Schematic diagram of testing apparatus

Specific heat values were obtained from handbooks and no experimental determination was made. Since these values are virtually constant for the same type of material, irrespective of other physical properties, further qualification seemed unnecessary.

Densities of the materials were determined from samples obtained at the time of construction of the test sections. Thicknesses of the various layers were measured while the section was being constructed.

The emissivity of the asphalt surfaces was determined by means of a radiometer and apparatus already described[5]. Solar absorptance was computed from spectral light reflectance data[6]. As these data covered approximately 75 percent of the total energy in the solar spectrum, it was assumed that this result could be applied to the entire solar spectrum without much error.

The manner in which the surface coefficients were calculated is shown in Appendix A. All physical properties and surface coefficients are listed in Table 1.

Testing Procedure

On the basis of weather forecasts, test periods were so chosen that they might be expected to closely approach the conditions set forth in the Mackey-Wright equations. One of these conditions requires that the steady periodic state be attained. This is reached if the test section is subjected to a sufficient number of identical cycles of sol-air temperature that the temperature of any point in the section goes through the same cycle day after day. Actually, it was found that for this construction, the steady periodic state was attained if the 10-hr period preceding the 24-hr test period was duplicated during the last 10 hr of the test period. As would be expected, because of day-to-day differences in weather, even this condition was not precisely attained and a transient heat-flow component resulted. The effect of this transient component upon the thermal behavior of the roof section was rationally evaluated as described in Appendix B.

Table 1—Physical Properties of Materials Used in Test Section

Material	Conductivity Btu/(hr) (sq ft) (deg F/in)	Specific Heat Btu/(lb) (deg F)	Density Lb/cu ft	Thickness In.
Concrete	6.1	0.22	143.1	3
Insulation	0.42	0.28	21.3	2
Built-up Roofing	1.50	0.25	63.0	⅜
Emissivity of Surfaces (ϵ)		0.88, no units		
Solar Absorptivity of Surface (a)		0.91, no units		
Inside Surface Film Coefficient		1.2 , Btu/(hr) (sq ft) (deg F)		
Outside Surface Film Coefficient		3.0 , Btu/(hr) (sq ft) (deg F)		

All tests were run with the test section in a horizontal position. Readings were taken at regular intervals during the test, for a period of at least 10 hr before the test, and for at least a few hours after the test period. Tests were run with the test section in both the normal (concrete innermost) and reversed positions to study the effect of the order of materials upon the thermal behavior of the roof.

Observed Results

Curves of important observed results for Tests Nos. 2 and 3 (the ones chosen for comparison) are plotted in Figs. 2 and 3. Shown are inside and outside surface heat flows and surface temperatures and sol-air temperature. The latter is that equivalent temperature which produces the same rate of heat flow into the weather-side surface of the roof section as the combined effect of outdoor dry-bulb temperature, wind velocity, and radiation incident upon the surface. These observed quantities are also shown in Figs. 2 and 3. Radiation quantities are shown by two curves; one is the total solar radiation, which is the sum of the direct and diffuse components; the other is the low-temperature, long-wave length radiation absorbed by the weather-side surface of the roof section. The latter is all the radiation emitted by the outdoor environ exclusive of the sun. The radiation emitted by the roof surface is also shown. The net low-temperature radiation exchange between the roof and its surroundings is the difference between these last two curves. It will be noticed that although the low-temperature radiation absorbed by the roof section is a large part of the total incident radiation, the net low-temperature radiation exchange is at all times a negative quantity. The effective radiative temperature of the atmosphere, exclusive of solar radiation, ranged from 30 to 40 deg. well below the air temperature, except during the last part of Test No. 2, when the sky became overcast. This statement perhaps needs some explanation. On a clear, dry day when there is little water vapor or carbon dioxide in the lower atmosphere, a roof exchanges low-temperature radiation principally with the higher, colder atmosphere. As the sky becomes more and more overcast, a larger percentage of the exchange is with the lower air, and when the sky is completely overcast, the effective radiating temperature of the atmosphere is approximately equal to the air temperature. This explanation also clears up a seeming paradox seen in Figs. 2 and 3. During a portion of the night, the air temperature was above the outside roof surface temperature, and yet the roof was giving up heat. The roof was gaining heat by convection, but not as much as it was losing by radiation to the cold upper atmosphere. This difference was balanced by the heat given up by the warmer interior of the roof section.

It can be seen in Figs. 2 and 3 that the sol-air temperature exceeds the outside roof surface temperature while the roof is being warmed up and heat is flowing into the section. At other times the sol-air temperature is lower and drops below the air temperature during portions of the night.

In Table 2 are summarized observed 24-hr heat flows, average temperatures and conductances. The heat flows and the average temperatures are those obtained by integrating the curves of Figs. 2 and 3 and similar curves for Test Nos. 1 and 4. Observed conductance values were obtained from 24-hr average surface and interface temperatures and observed heat flows. The overall coefficient of heat transmission was determined from the average sol-air temperature and the average heat-sink temperature.

Lag Angles and Decrement Factors

The lag angle is defined as the time lag of the peak inside surface concrete side both in and out, a single ply of felt roofing was cemented on the indoor side to provide surfaces of the same emissivity and solar absorptivity on both sides of the section.

Care was taken in construction of the test section to assure no air blisters between the layers of the roof. The bonding materials used were a quick-setting, rubber-base adhesive and a high-melting-point asphalt.

Temperatures of each surface and each interface of the roof section were measured by sets of 14 copper-constantan thermocouples; six were placed diagonally in the center or *test area* of the roof and eight were placed in the outer or *guard area*. The *guard area* was 8 in. wide, sufficient to insure one-dimensional heat flow through the *test area*. (Temperature readings during the tests proved this to be so.) The surface thermocouples were imbedded slightly in the asphalt surface.

Heat flow was measured by means of four heat-flow meters placed on each surface within the *test area*. These heat-flow meters were the type[3] developed at the ASHAE Research Laboratory. They were bonded to the surfaces of the roof with asphalt and then covered with the same material to provide a surface having the same emissivity and solar absorptivity as the rest of the roof.

Switches were so wired that temperatures across the *test area* could be read individually or in parallel; temperatures in the *guard area* were read individually. The outside heat-flow meters were read individually or in parallel, and the inside heat-flow meters individually or in series. This arrangement made it convenient to check temperatures and heat flows against each other while tests were in progress.

Other Instrumentation

Solar radiation measurements were made with three Eppley multi-junction pyrheliometers. All were mounted horizontally, two adjacent to the roof and the third on a nearby tower. One pyrheliometer adjacent to the roof measured total radiation and, by means of a shading device, the other measured diffuse radiation. The third could check either of the other two.

A shielded, aspirated thermocouple was used to measure outdoor dry-bulb temperature. Also, at regular intervals, outdoor dry-bulb and wet-bulb temperatures were taken with an aspirated psychrometer.

Low-temperature outdoor radiation measurements were made with a convection-compensated radiometer developed at the ASHAE Laboratory and described in Reference 4.

Wind velocity was measured with a cup-type anemometer and wind direction by a wind vane. General sky conditions were also noted.

The outputs of the thermocouples, heat flow meters, and pyrheliometers were read on an electronic, self-balancing potentiometer. In addition, a record was made on the 16-point high-speed recorder of the following: (*a*) temperatures of the outside roof surface, (*b*) temperatures of the inside roof surface, (*c*) temperatures of the heat-sink surface, (*d*) heat flowing at the inside and outside surface, (*e*) amount of total solar radiation, and (*f*) amount of diffuse solar radiation. The recorder also provided a continuous record of those values most subject to fluctuations, making it possible to average them.

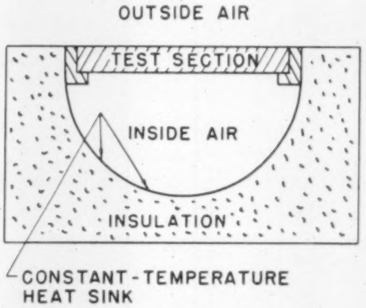
Calibration of Heat Flow Meters

A number of heat-flow meters were calibrated on a cooled plate by means of the portable calibrator described in Reference 3. From this number, groups of four were selected which had calibration constants within 10 percent of each other. The meters were then re-calibrated with the portable calibrator after they were cemented in place on the roof section.

Physical Properties

It was important that the physical values of the materials used in the roof section be accurately ascertained to provide a valid comparison between calculated and observed results. The importance of each value cannot be determined without lengthy and involved calculations. However, particular attention was paid to obtaining accurate conductance values, since they are most subject to variations.

To check the conductances of the various materials, conductance tests were run while the roof was in place in the test apparatus. An aluminum foil container large enough to cover the entire roof surface was put in place and filled with crushed ice. The calorimeter surface (normally the heat sink) was kept at a constant elevated temperature. From the heat flows and the temperatures of the interfaces and surfaces of the test section observed under equilibrium conditions, the overall conductance and the conductance of each layer were computed. These values, except for the concrete, agreed very well with handbook values.



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On the basis of weather forecasts, test periods were so chosen that they might be expected to closely approach the conditions set forth in the Mackey-Wright equations. One of these conditions requires that the steady periodic state be attained. This is reached if the test section is subjected to a sufficient number of identical cycles of sol-air temperature that the temperature of any point in the section goes through the same cycle day after day. Actually, it was found that for this construction, the steady periodic state was attained if the 10-hr period preceding the 24-hr test period was duplicated during the last 10 hr of the test period. As would be expected, because of day-to-day differences in weather, even this condition was not precisely attained and a transient heat-flow component resulted. The effect of this transient component upon the thermal behavior of the roof section was rationally evaluated as described in Appendix B.

Table 1—Physical Properties of Materials Used in Test Section

Material	Conductivity Btu/(hr) (sq ft) (deg F/in)	Specific Heat Btu/(lb) (deg F)	Density Lb/cu ft	Thickness In.
Concrete	6.1	0.22	143.1	3
Insulation	0.42	0.28	21.3	2
Built-up Roofing	1.50	0.25	63.0	3/8
Emissivity of Surfaces (ϵ)		0.88, no units		
Solar Absorptivity of Surface (α)		0.91, no units		
Inside Surface Film Coefficient		1.2 , Btu/(hr) (sq ft) (deg F)		
Outside Surface Film Coefficient		3.0 , Btu/(hr) (sq ft) (deg F)		

All tests were run with the test section in a horizontal position. Readings were taken at regular intervals during the test, for a period of at least 10 hr before the test, and for at least a few hours after the test period. Tests were run with the test section in both the normal (concrete innermost) and reversed positions to study the effect of the order of materials upon the thermal behavior of the roof.

Observed Results

Curves of important observed results for Tests Nos. 2 and 3 (the ones chosen for comparison) are plotted in Figs. 2 and 3. Shown are inside and outside surface heat flows and surface temperatures and sol-air temperature. The latter is that equivalent temperature which produces the same rate of heat flow into the weather-side surface of the roof section as the combined effect of outdoor dry-bulb temperature, wind velocity, and radiation incident upon the surface. These observed quantities are also shown in Figs. 2 and 3. Radiation quantities are shown by two curves; one is the total solar radiation, which is the sum of the direct and diffuse components; the other is the low-temperature, long-wave length radiation absorbed by the weather-side surface of the roof section. The latter is all the radiation emitted by the outdoor environ exclusive of the sun. The radiation emitted by the roof surface is also shown. The net low-temperature radiation exchange between the roof and its surroundings is the difference between these last two curves. It will be noticed that although the low-temperature radiation absorbed by the roof section is a large part of the total incident radiation, the net low-temperature radiation exchange is at all times a negative quantity. The effective radiative temperature of the atmosphere, exclusive of solar radiation, ranged from 30 to 40 deg. well below the air temperature, except during the last part of Test No. 2, when the sky became overcast. This statement perhaps needs some explanation. On a clear, dry day when there is little water vapor or carbon dioxide in the lower atmosphere, a roof exchanges low-temperature radiation principally with the higher, colder atmosphere. As the sky becomes more and more overcast, a larger percentage of the exchange is with the lower air, and when the sky is completely overcast, the effective radiating temperature of the atmosphere is approximately equal to the air temperature. This explanation also clears up a seeming paradox seen in Figs. 2 and 3. During a portion of the night, the air temperature was above the outside roof surface temperature, and yet the roof was giving up heat. The roof was gaining heat by convection, but not as much as it was losing by radiation to the cold upper atmosphere. This difference was balanced by the heat given up by the warmer interior of the roof section.

It can be seen in Figs. 2 and 3 that the sol-air temperature exceeds the outside roof surface temperature while the roof is being warmed up and heat is flowing into the section. At other times the sol-air temperature is lower and drops below the air temperature during portions of the night.

In Table 2 are summarized observed 24-hr heat flows, average temperatures and conductances. The heat flows and the average temperatures are those obtained by integrating the curves of Figs. 2 and 3 and similar curves for Test Nos. 1 and 4. Observed conductance values were obtained from 24-hr average surface and interface temperatures and observed heat flows. The overall coefficient of heat transmission was determined from the average sol-air temperature and the average heat-sink temperature.

Lag Angles and Decrement Factors

The lag angle is defined as the time lag of the peak inside surface temperature behind the peak sol-air temperature and may be expressed in degrees or hours. The decrement factor is a dimensionless ratio which may be defined as follows:

$$\text{decrement factor} = (t_i \max - t_i \text{ avg}) / (t_e \max - t_e \text{ avg})$$

where

t_i max, t_e max = maximum inner surface and sol-air temperatures, respectively.

t_i avg, t_e avg = 24-hr average inner surface and sol-air temperature, respectively.

This definition is necessary since the sol-air and inside surface temperature curves, as seen in Figs. 2 and 3, are composite and irregular. The observed and calculated lag angles and decrement factors listed in Table 2 were obtained graphically from these curves. If the curves of the sol-air and inside-surface temperatures had been regular sine curves, the decrement factors would have been simply the ratio of their amplitudes.

In Table 3 are listed the harmonic lag angles and harmonic decrement factors as calculated by the Mackey-Wright equations. Values are given for only the first two harmonics (*i.e.* fundamental and second harmonic), subsequent harmonics having a negligible effect. The manner in which these values were used to obtain the calculated inside-surface temperature curves is discussed in Appendix A.

Comparison of Results

From the data taken, four usable 24-hr test periods were found, two with the concrete innermost and two in the reversed position. Fortuitously, one test in each position (Tests Nos. 2 and 3) was found to closely approximate the required idealized conditions, while in the others some correction for a transient component of heat flow was necessary. It seems wise to confine analysis and comparison principally to Tests Nos. 2 and 3. The conclusions drawn, however, apply qualitatively also to the other tests when corrections for the transient component are made.

Table 2—Summary of Test and Calculated Values

		Units	Test Number			
			1[a]	2[a]	3[b]	4[b]
24-hr Heat Flow Rates		Btu/(day)(sq ft)				
Into outside surface	— test		67.4	107.6	45.4	19.7
Stored in roof section	— test	″	−26.3	−2.4	−0.6	−24.8
Outside surface-stored	— test	″	93.7	110.0	46.0	44.5
From inside surface	— test	″	85.4	104.6	61.1	65.9
From inside surface	— calc.[c]	″	84.4	99.1	56.4	59.3
24-hr Average Temperatures						
Sol-air	— test	F	93.2	100.9	89.5	91.2
Outside surface	— test	″	92.3	99.6	88.9	90.4
Inside surface	— test	″	77.4	78.0	76.1	76.7
Inside surface	— calc.[c]	″	77.5	78.1	76.4	76.4
Heat-sink	— test	″	74.8	74.9	74.5	74.7
Conductances		Btu/(hr)(sq ft)(F)				
Surface-to-surface:						
From 24-hr test				0.201	.198	
Steady-state test		″		0.183	.183	
Built-up roofing:						
From 24-hr test		″		3.95	3.63	
Steady-state test		″		4.01	4.01	
Insulation:						
From 24-hr test		″		0.236	0.231	
Steady-state test		″		0.211	0.211	
Concrete:						
From 24-hr test		″		2.07	2.31	
Steady-state test		″		2.05	2.05	
Heat transmission coefficient, *U*						
From 24-hr test		″		0.167	0.169	
From Steady-state conductances				0.149	0.149	
Decrement factor						
test		no units	0.0416	0.0379	0.0610	0.0705
calculated[c]		″	0.0429	0.0394	0.0842	0.0893
Lag Angle						
test		degrees	85.	82.	63.	65.
calculated[c]		″	79.	75.	58.	57.
test		hours	5.7	5.5	4.2	4.3
calculated[c]		″	5.3	5.0	3.9	3.8

[a]Concrete on inside of roof section; [b]Concrete on weather-side of roof section; [c]Calculated from Mackey-Wright equations.

In this paper, calculated results refer to values obtained from the Mackey-Wright equations, and observed or test values to those obtained from experimental results. For comparison, the calculated inside surface heat flow and temperature curves are plotted in Figs. 2 and 3. The comparison of calculated and observed inside surface heat flows is of prime importance in this study. To make a comparison of results clear, the assumed conditions used to obtain the calculated results should be pointed out. As stipulated by Mackey and Wright, they are:

1. The temperature of the outdoor air, the total solar radiation, and low-temperature radiation incident upon the outer surface of the roof are cyclic with a period of 24 hr.
2. The temperature of the indoor air (heat sink in these tests) is constant.
3. The rate of heat transfer by convection and radiation between the outdoor air and the outside surface per degree temperature difference is constant.
4. The rate of heat transfer by convection and radiation between the indoor surface and the indoor air (heat sink) per degree temperature difference is constant.
5. The roof is composed of three layers arranged in series in the direction of heat flow, each layer being itself a single homogeneous material.
6. The three layers make perfect thermal contact at their adjoining faces.

Primarily, only conditions 3 and 4 need be considered in the analysis of results. Condition 1 was either closely approximated or rationally corrected for, condition 2 was maintained during the testing periods, and conditions 5 and 6 were met when the test section was constructed.

Table 3—Calculated Harmonic Lag Angles and Harmonic Decrement Factors

Test No.	Harmonic	Lag Angle		Decrement Factor
		Degrees	Hours	
1 & 2	1	90.4	6.0	0.0482
	2	117.4	3.9	0.0290
3 & 4	1	67.0	4.5	0.0923
	2	111.0	3.7	0.0600

In Test No. 2 (concrete innermost) there is excellent agreement between the calculated and observed inside surface heat flows (Fig. 2). This means that the lag angles and decrement factors obtained by the two methods agree closely. It will be noticed in Fig. 2 that the inside surface heat flow is positive (from the inside surface to the heat sink) at all times. Any effect caused by an assumption of a constant inside-surface coefficient is negligible since, within the range of temperatures encountered in these tests, the coefficient is virtually constant as long as the direction of heat flow remains the same. The small discrepancies in the heat flows shown in Fig. 2 can be attributed to small changes in the heat-sink temperature.

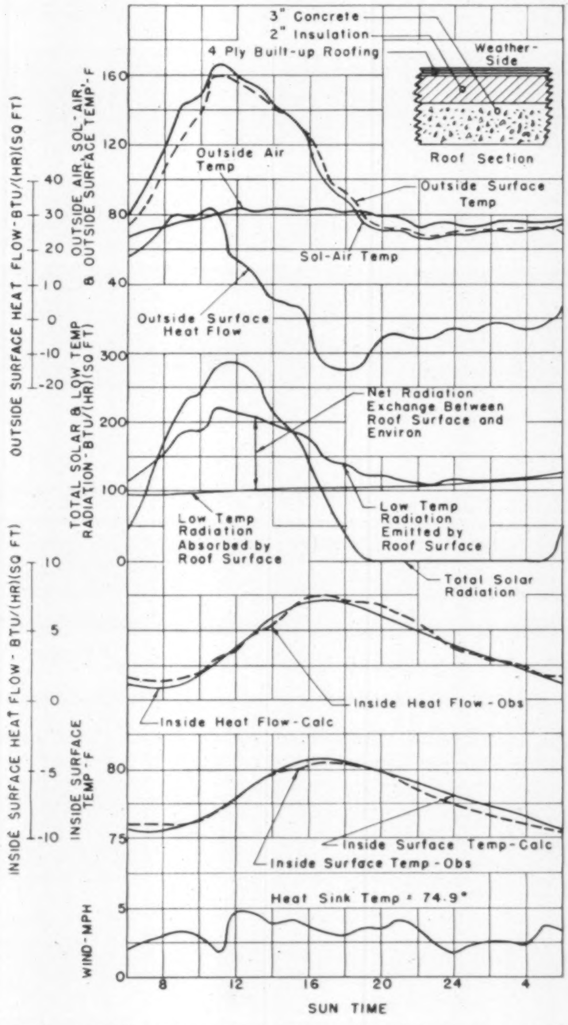

Fig. 2—Results of Test No. 2, data observed July 28-29, 1953

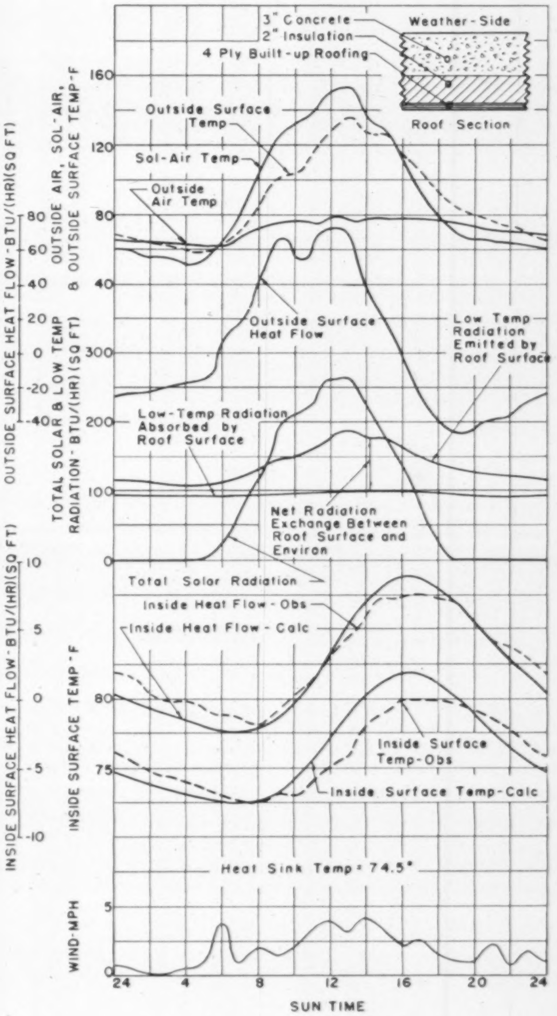

Fig. 3—Results of Test No. 3, data observed August 11, 1953

In Test No. 3, agreement between calculated and observed inside surface heat flows is not quite as good. The lag angles agree and, although the summation of observed and calculated heat flows for a 24-hr period agree closely, the decrement factor of the observed curve is less than that of the calculated curve. Major cause of discrepancies, it seems, lies in the assumption of a constant inside-surface coefficient. In Test No. 2 with constant direction of heat flow, this assumption was valid, but not in Test No. 3. In this test there was a reversal of heat flow and subsequently a change in surface coefficient. The radiation portion of the coefficient remains the same irrespective of the direction of heat flow, but the convection portion is much higher for upward heat flow. Proper evaluation of the effect cannot be readily computed. The use of an analogue computer or similar device capable of having a step change made in the coefficient would be necessary.

The effect of order of materials is clearly shown in the observed results. As predicted by the Mackey-Wright equation, a roof with a material of lesser density outermost has a greater lag angle and a smaller decrement factor than for the reversed position. It is also seen in Table 2 that for all tests there is reasonably good agreement between the summation of the outside surface heat flow minus the heat storage, and the calculated and observed inside surface heat flows. The heat storage was evaluated using the average surface temperatures of each layer and assuming a straight-line relationship of temperature with distance from the surface. However, the temperature gradient through a particular layer is not necessarily a straight-line function and consequently, the heat storage is an approximation. This could account for a portion of any differences present.

Good agreement is also shown between conductance values obtained by steady-state conductance tests and observed values (both previously described). Conductance values were not calculated for Test Nos. 1 and 4, since appreciable heat storage took place and proper evaluation of its effect was not possible.

Conclusions

1. The calculated inside surface heat flow obtained using Mackey and Wright's equations agree closely with observed values, better agreement being achieved when the inside surface heat flow remains in one direction, than when a reversal takes place.

2. The predicted effect of order of materials was substantiated. With the material of higher density outermost, the decrement factor is larger and the lag angle smaller than for the reversed position. Practically speaking, this means that the maximum rate of heat flow from the inside surface is larger and the time lag smaller when the material of higher density is outermost.

3. The limitations of assuming a constant outside surface coefficient could not be determined. A good recommendation seems to be to use the average daytime wind velocities for evaluating the outside surface coefficient. This is discussed in Appendix A.

4. The assumption of a constant inside surface coefficient is valid only when heat flow is in one direction. For horizontal surfaces, reversal of heat flow causes a significant change in the coefficient with a subsequent change in heat flow.

It should be pointed out that the tests are for only two particular roof constructions (actually one roof in two positions). For other types of construction having different thermal properties and orientation, observed results will be different. In the extreme case of a horizontal roof having a very small thermal resistance and a reversal of inside surface heat flow, the comparison of calculated and observed results may also differ. In this case the inside surface film coefficient would be a bigger part of the overall thermal resistance and would probably have a greater effect.

References

1. ASHVE Research Report No. 1299 — Periodic Heat Flow — Composite Walls or Roofs, by C. O. Mackey and L. T. Wright, Jr. (ASHVE Transactions, Vol. 53, 1946, Appendix, p. 289).

2. ASHVE Research Report No. 1333 — Measurements of Solar Heat Transmission Through Flat Glass, by G. V. Parmelee, W. W. Aubele and R. G. Huebscher (ASHVE Transactions, Vol. 54, 1948, p. 165).

3. ASHVE Research Report No. 1453 — A Low-Inertia Low-Resistance Heat Flow Meter, by R. G. Huebscher, L. F. Schutrum and G. V. Parmelee (ASHVE Transactions, Vol. 58, 1952, p. 275).

4. ASHVE Research Report No. 1442 — Radiant Energy Emission of Atmosphere and Ground — A Design Factor in Heat Gain and Heat Loss, by G. V. Parmelee and W. W. Aubele (ASHVE Transactions, Vol. 58, 1952, p. 85).

5. ASHVE Research Report — Measurement of Angular Emissivity, by Aydin Umur, G. V. Parmelee and L. F. Schutrum (ASHVE Journal Section, *Heating, Piping & Air Conditioning*, November 1954, p. 135).

6. Private communication from Dr. W. J. Arner (Libby-Owens-Ford Glass Co.: July, 1953).

APPENDIX A

Calculation Methods

Surface Coefficients: To calculate heat flow rates through a building section in the steady periodic state, it is necessary to know the physical properties of the section, the indoor and outdoor surface coefficients and the sol-air temperatures. The physical properties were determined experimentally as described earlier. The surface coefficients were calculated from a heat balance on the outer roof surface. The heat balance equation is:

$$\alpha\, I_T = \epsilon(\sigma T_s^4 - R) + h_c(t_s - t_a) + q_{in} \quad \ldots\ldots\ldots\ldots\ldots\ldots (A\text{-}1)$$

where

α = solar absorptivity of roof surface, no units.

I_T = total incident solar radiation, Btu per (hour) (square foot).

ϵ = emissivity of roof surface, no units.

σ = Stefan-Boltzmann constant = 0.173×10^{-8} Btu per (hour) (square foot) (Fahrenheit degree absolute)^4.

R = incident low-temperature radiation, Btu per (hour) (square foot).

t_s, T_s = outside roof surface temperature, Fahrenheit and Fahrenheit absolute, respectively.

t_a, T_a = outdoor air temperature, Fahrenheit and Fahrenheit absolute, respectively.

q_{in} = measured heat flow into outer roof surface, Btu per (hour) (square foot).

h_c = convective conductance, Btu per (hour) (square foot) (Fahrenheit degree).

The methods by which α and ϵ were obtained have been described in the paper. I_T, R, t_s, t_a and q_{in} were determined from test data. Thus, with all other values known in Equation A-1, h_c could be computed.

In calculating the sol-air temperatures it is necessary to consider the low-temperature radiation exchange. This can be facilitated by rewriting Equation A-1 as follows:

$$\alpha I_T = \epsilon\sigma(T_s^4 - T_a^4) + \epsilon(\sigma T_a^4 - R) + h_c(t_s - t_a) + q_{in} \quad \ldots. (A\text{-}2)$$

A radiation exchange coefficient, h_r can now be defined by the relationship:

$$h_r(t_s - t_a) = \epsilon\sigma(T_s^4 - T_a^4) \quad \ldots (A\text{-}3)$$

This value of h_r can be added to h_c to give a combined outside surface coefficient, $h_c + h_r$. Values of $h_c + h_r$ computed from the test data for all four tests varied from 1.14 to 3.82 Btu/(hr) (sq ft) (F deg).

Because calculations by the Mackey-Wright equations required a constant surface coefficient, an average value was computed by weighting $h_c + h_r$ according to $(t_s - t_a)$. This yielded an average substantially equal to 3.00 Btu/(hr) (sq ft) (F deg).

The inside surface coefficient was obtained by dividing hourly measured values of inside surface heat flow by the observed temperature difference between the inside roof surface and the heat sink. These values were then averaged as before. The range of values varied from 0.94 to 1.53 Btu/(hr) (sq ft) (F deg), the larger values occurring when the heat flow was upwards. The average value was 1.20 Btu/(hr) (sq ft) (F deg).

Sol-Air Temperatures: The sol-air temperature is that equivalent temperature, t_e, which combines radiation, wind, and air temperature in such a way as to give the same rate of heat flow into the weather surface of the roof as actually takes place, that is,

$$q_{in} = (h_c + h_r)\,(t_e - t_s) \;\ldots\ldots\,(A\text{-}4)$$

from which

$$t_e = t_s + q_{in}/(h_c + h_r) \;\ldots\ldots\,(A\text{-}5)$$

The sol-air temperature can also be computed from Equation A-2 thus:

$$t_e = [aI_T - \epsilon(\sigma T_a^4 - R)]/(h_c + h_r) + t_a \;\ldots\ldots\,(A\text{-}6)$$

Because q_{in} and t_s were observed in these tests, for the sake of accuracy, t_e was evaluated by Equation A-5. If all values in Equation A-6 are known accurately, the same results would be obtained. Comparison of the sol-air temperatures obtained by the two methods showed very close agreement.

In the practical problem of load estimating, Equation A-6 must be used. Although t_s is not known, in such cases a rough estimate is sufficiently accurate for determining h_r, because it is a function of the mean of t_s and t_a, the latter is known, and h_r does not change too rapidly with mean temperature. A further practical observation is that these tests showed that a simple average of the daytime values of $h_c + h_r$ is a good approximation to use in practical calculations where $h_c + h_r$ is known to vary.

Harmonic Analysis: For computation purposes, the sol-air temperature must be expressed as a mathematical function. A Fourier analysis was made of the curve by the method described by Alford, et al†. This yields an equation as follows:

$$t_e{}^* = t_{eo} + a_1 \cos \omega\theta + b_1 \sin \omega\theta + a_2 \cos 2\omega\theta + b_2 \sin 2\omega\theta + \ldots\ldots\ldots\,(A\text{-}7)$$

where

t_{eo} = 24-hr average sol-air temperature, Fahrenheit.
a, b = Fourier or harmonic coefficients; subscripts denote the harmonic number, no units
θ = Time, hours
ω = Degrees per hour

This equation can be reduced to a more usable form, thus:

$$t_e{}^* = t_{eo} + t_{e1} \cos (\omega\theta - \beta_1 + t_{e2} \cos (2\omega\theta - \beta_2) + \ldots\ldots\,(A\text{-}8)$$

where

$t_{e1} = \sqrt{a_1^2 + b_1^2}$; $t_{e2} = \sqrt{a_2^2 + b_2^2}$; etc.
$\tan \beta_1 = b_1/a_1$; $\tan \beta_2 = b_2/a_2$; etc.

Computation of Inside Surface Temperatures and Heat Flows: The inside-surface temperature, t_i, is computed from the following equation

$$t_i{}^* = t_{io} + M_{L1}\, t_{e1} \cos (\omega\theta - \beta_1 - m_{L1}) + M_{L2}\, t_{e2} \cos (2\omega\theta - \beta_2 - m_{L2}) + \ldots\ldots\ldots\,(A\text{-}9)$$

where

M_{L1}, M_{L2} = amplitude decrement factors, no units.
m_{L1}, m_{L2} = phase lag angle, degrees.

The amplitude decrement factors and the phase lag angles are computed by the Mackey-Wright equations. t_{io} is the 24-hr average inside-surface temperature calculated from the relationship:

$$U(t_{eo} - t_c) = h_i(t_{io} - t_c) \;\ldots\,(A\text{-}10)$$

where

t_c = constant heat sink temperature, Fahrenheit.

The U value was determined from the relationship

$$1/U = 1/(h_c + h_r) + 1/C + 1/h_i \;\ldots\ldots\ldots\,(A\text{-}11)$$

where

C is the steady-state surface-to-surface conductance value and $h_c + h_r$ and h_i are the surface coefficients determined as described above. The heat flow rate, q, from the inside surface of the roof section to the heat sink is

$$q = h_i\,(t_i - t_c),\ \text{Btu/(hr) (sq ft)} \;\ldots\ldots\ldots\,(A\text{-}12)$$

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*In Fahrenheit degrees.

†Effect of Heat Storage and Variation in Outdoor Temperature and Solar Intensity on Heat Transfer Through Walls, by J. S. Alford, J. E. Ryan, and F. O. Urban (ASHVE Transactions, Vol. 45, 1939, Appendix III, p. 393).

APPENDIX B

Evaluation of Transient Heat Flow Component

Because of the presence of a transient component of heat flow, a study was made to estimate its magnitude and duration in all tests. A thermal circuit to represent the roof section was drawn. This consisted of a number of resistances and capacitances, and a cyclic input arranged as in Fig. B-1. The input function was a Fourier representation of the sol-air temperature. The solution of any problem concerning this circuit is similar to that for an analagous electrical circuit. Solution of the three simultaneous first-order differential equations which represented this circuit, showed that the transient component was substantially zero at the end of 10 hr. About the same result was obtained from a solution for a circuit using two capacitances instead of three and solved on an electronic differential analyzer. Because the time lag of the roof section was five to six hours, it was reasoned that the contribution of the transient component to the indoor surface of the roof section could be obtained from experimental observations as follows: The surface temperatures observed during the first five or six hours immediately following the test period are steady-periodic-state values resulting from the sol-air temperature of that period. Because of the time lag, the sol-air temperature of the second period has as yet, had no effect. Furthermore, the transient heat flow component of the first period died out fourteen hours earlier. Therefore, the transient contribution is the difference between the temperatures observed during the first five or six hours of the period being analyzed and the temperatures of the corresponding hours of the second cycle or period. A plot of these temperature differences against time and extrapolation to zero at ten hours, therefore, should yield the complete transient contribution. The heat flows computed from this temperature difference curve checked roughly the heat stored in the roof section found by computation from the initial and final temperatures observed during the period of analysis. Corrections to the observed indoor surface temperatures were therefore made according to this principle.

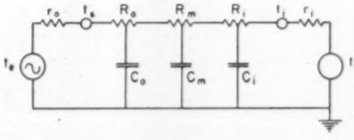

Fig. B-1—Thermal circuit of test section

R_o, R_m, R_i = thermal resistances of the outer, middle, and inner layers, respectively, Btu per (hour) (square foot) (Fahrenheit degree).
C_o, C_m, C_i = thermal capacitances of the outer, middle, and inner layers, respectively, Btu per (square foot) (Fahrenheit degree), (connected to center of resistance).
r_o, r_i = thermal resistances of the outer and inner surface films, respectively, Btu per (hour) (square foot) (Fahrenheit degree).
t_e = cyclic sol-air temperature, Fahrenheit.
t_c = constant heat-sink temperature, Fahrenheit.
t_s, t_i = outside and inside surface temperatures, respectively, Fahrenheit.

Journal Section

JAMES FEATURED SPEAKER at UTAH CONFERENCE

Under the sponsorship of the ASHAE UTAH Chapter the 2nd Annual Intermountain Heating and Air Conditioning Conference was held April 28-29 in the Union Building of the University of Utah.

The highlight of the conference was a talk by John W. James, Chicago, first vice president of ASHAE, at the banquet which was well attended by Utah Chapter members, their wives and guests. Mr. James' talk, which was equally interesting to members and to the ladies, was entitled, *Does Air Conditioning Provide a Healthful Indoor Environment.* His treatment of the subject was both entertaining and factual.

During the two-day conference there was a total of 10 technical papers presented and discussed. Some of the more popular papers were, *Snow Melting Systems*, by W. P. Chapman; *A New Look for Coal*, by J. L. Margetts; *High Temperature Hot Water*, by P. L. Geiringer; and *Firm Specifications*, by Kenneth Wilson.

Of particular interest was a panel discussion on *Sound Control* with Don Callaway as moderator. Others who participated in the discussion were Franklin Gates, E. V. Gritton, past president of the Utah Chapter and A. A. Maycock, now president of the Utah Chapter.

The success of the conference was largely due to the efforts of the Conference General Committee, especially to Prof. W. P. Barnes, conference director, and to Mr. Maycock, as well as to R. V. Smith, H. W. Bentley, R. C. Evans, M. B. Hogan, S. S. Kistler, W. R. Olsen, and W. L. Stuewe.

ASRE MEETS IN MILWAUKEE

Pres. John E. Haines represented the ASHAE at the 42nd Semi-Annual Meeting of *ASRE* held June 12-15, at which there were three technical sessions, two conferences and six forums.

The Air Conditioning Conference heard reports from four speakers on the results obtained at the *NAHB* Air Conditioning Village at Austin, Tex. Especially interesting was the report that users of the houses found conditions acceptable at from 75-78 dry bulb, with 40-60 percent relative humidity and continuous fan circulation. The general feeling of the speakers was that the Village had produced valuable field data on which designs for residential air-conditioning equipment can be based.

SOCIETY GREETING SENT *ASME*

The Society was represented by R. A. Wolff, New York, at the 75th Anniversary Meeting of the *American Society of Mechanical Engineers.* The meeting was held April 16 at Stevens Institute of Technology, Hoboken, N. J., in the same meeting hall where *ASME* held its organization meeting on April 7, 1880.

An alumnus of Stevens Institute and a member of *ASME*, Mr. Wolff presented the written greetings of Pres. John E. Haines, on behalf of the Society and Council. In his letter President Haines commended *ASME* for its contributions to the growth and development of the profession and American industry.

OLSTAD NAMED VICE PRESIDENT

M. H. Olstad has been appointed vice president in charge of engineering, Niagara Blower Co., New York, N. Y., according to a recent announcement by the company. Mr. Olstad, a member of ASHAE, has been chief engineer for the past ten years.

BOOK ON TURBOBLOWERS

Turboblowers, by A. J. Stepanoff, Ph.D., John Wiley & Sons, Inc., New York, N. Y., 6 x 9¼ in., 377 pp., $8.00

In the past 15 years unprecedented developments have taken place in the field of application of turbomachinery for the compression of gases and vapors. The book deals with the hydrodynamic and thermodynamic aspects of the turboblower design. It outlines new methods of attack on turbomachine problems, and discusses the art of building turbocompressors in the United States and aboard. European designs occupy a prominent part of the book.

In addition to offering a balanced picture of past and current work in the field, the author explores a number of new methods and techniques. He presents a theoretical treatment of the compressor impeller based on a single pattern of flow, and extends this treatment to similar design procedure for centrifugal and axial flow impellers. Another chapter stresses the hydrodynamic nature of pressure generation as contrasted with the indirect thermodynamic basis commonly adopted in the past. A large chapter is devoted to water cooled compressors. Here a design method is offered with detailed numerical examples and complete energy balance.

The author's axial flow compressor design method is based on actual fluid deflection and observed pressure and capacity coefficients rather than lift and drag coefficients, which are a part of air foil theory.

John R. Allen Memorial Library

The ASHAE Committee on Research gratefully acknowledges the following gift to the John R. Allen Memorial Library, which is maintained at the Society's Research Laboratory, 7218 Euclid Ave., Cleveland 3, Ohio.

Handbook of Hazardous Gases and Vapors in Industry, by Joel F. Bailey and Burgess H. Jennings. Gift of *Ventilating and Air Conditioning Contractors' Association of Chicago.*

The presentation of textbooks and pamphlets in the field of heating, ventilating and air conditioning and allied fields, by authors and others, will be welcomed by this library. Suitable book plates carry the name of the donor and date of the gift.

THE PRESIDENT'S PAGE

The Engineer's Responsibility

WE are fortunate to live in the only part of the world where men are free to think, free to speak, free to worship, and free to enterprise to their own benefit. Here we enjoy the highest standard of living, the greatest amount of comfort, the longest lives, and the greatest degree of freedom from worry.

We can thank the engineer for his contributions to the development of our way of life, especially in the last half century. Engineers have had a vital part in creating the efficiency and ease of better living comfort for everyone.

Up to now, the engineer's contributions have been all too little recognized. With changing conditions, however, we can confidently expect that during the next few years, the engineer will really come into his own and receive the recognition so amply due him.

Engineers are trained to think straight, and today more than ever before, we need straight thinking to meet the increasing problems of our time. As engineers we must accept the responsibility of taking a more active part in the important activities of our communities for the benefit of our fellow men as well as in the advancement of our profession.

This situation, however, does not mean that we engineers can afford to sit back, relax and be complacent, because now is the time to grasp our opportunities and to face our responsibilities. It is also a suitable time for raising some pointed questions.

Have these changes of the last half century which have permitted shorter work weeks, higher wages, and all of the comforts which make life more enjoyable also brought about some unwanted effects on the moral fiber of the public? Also, as engineers, are we ourselves subject to some of these same effects?

Is there a growing tendency in our field to put price ahead of quality, and are we avoiding our responsibilities as engineers? Would it not be unthinkable to re-evaluate our ethical standards?

Surely we must all be fully aware of some of the problems and also aware that many inadequate heating, ventilating, cooling and air-conditioning systems are being installed in homes, commercial, industrial and institutional buildings.

Many reasons exist for this state of affairs, but perhaps lack of understanding by architects and owners of what constitutes adequate heating and air conditioning, and the indifference of the manufacturer, contractor and engineer in doing a conscientious job are the main factors.

As individuals, a part of our responsibility is to combat such conditions. We must see that no such viewpoints are allowed to affect our own actions. We must stay with the time-proven principles followed as the engineer climbed toward public recognition.

Our Society also has a responsibility in this. It must educate its members, the architects, and the general public through publication of definitions, codes and standards; and, by its public-relations efforts it must help create the desire for adequate heating, ventilation, cooling and air conditioning wherever people live, work or assemble.

This whole matter presents a challenge to the Society and to every member and the question is "Are we going to meet this challenge?"

J.E. Haines
President
AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS

Air Cleaning

By A. B. Algren,* Minneapolis, Minn.

Air pollution is a real and present menace in some important metropolitan areas. In others, it is a nuisance.

Public attention is directed toward a solution as never before. This probably is due in part to a rising living standard; and partly because of an increased awareness that unclean air is a potential menace wherever there is a concentration of population and of industrial activity.

The problem is complex. It has many phases. Considering this, the Technical Advisory Committee on Air Cleaning decided to emphasize the development of fundamental data needed to establish acceptable test methods. Such methods are basic to a solution of the general problem. Moreover, a program of this character is in accord with the present scope of the Committee, viz:

"The study of the basic character of the contaminants present in the air and the factors influencing their removal from air delivered to a confined space, so as to make available information necessary for the development by others of standard methods for testing and rating of all types of air-cleaning devices; and to make available information for determining by others which removal method or combination of methods is most effective for any particular condition and purpose."

The Problem and the Project

Basic to any improved methods for evaluating air cleaners is an adequate knowledge of the air contaminants which must be removed under given conditions. Both the concentration and character of air contaminants vary widely from place to place, and also show wide differences in a given location at various times of the day and year. For this reason it is considered essential that suitable equipment and procedures be available for taking on-the-spot samples of dust to supplement data for so-called typical conditions.

From the dust samples obtained, the engineer is then interested in determining the dust concentration in the air, and the particle size distribution of the sample. Other characteristics of the dust, such as the particle shape, density, and composition are also of interest, and may influence the determination of particle size distribution.

To develop methods of determining these and other related data, a cooperative research project is in progress at the University of Minnesota under the advisory guidance of the TAC on Air Cleaning. Although the agreement has been in effect for less than a year, progress to date has been most gratifying.

Gratifying Progress

A complete review of the literature on the subject has been made, and various test procedures have been checked and evaluated in the Laboratory. The ultimate goal of the research is the development of test methods which will give accurate results in a reasonable time with relatively simple and inexpensive equipment, which can be operated by the average laboratory technician. To date, the program has resulted in the following developments:

1. A new sedimentation size analysis method suitable for measuring concentration and size distribution of airborne dusts in the 0.3 to 100 micron size range.
2. A practical method of obtaining dust samples on millipore filters that are suitable for sedimentation analysis.
3. A simple method for studying dust fall by transmitted light measurements.

The new sedimentation size analysis method mentioned in (1) was described in a paper presented at the 1955 annual meeting.

Future Plans

While these accomplishments are noteworthy, they do not indicate completion of the project. The effects of particle shape and density must be studied and test procedures and techniques modified if necessary. The effect of agglomeration of some types of particles also merit careful consideration. Lint poses other problems, both in dust sampling and in air cleaning and these problems require solution.

Development work is now under way on improved photometric instruments which may be used to study airborne dust concentrations, and to determine the uniformity of dispersion of artificial test dusts for air cleaner testing and related purposes.

It is planned to try out the new test equipment and techniques as soon as possible, by making a limited survey of dust concentrations in several cities. Members of the TAC will assist in this phase of the work.

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*Chairman, ASHAE Technical Advisory Committee.

Summary of Chapter Meetings*

SOCIETY OFFICERS PRESENT CHARTER TO 60TH CHAPTER AT SPRINGFIELD, MASS.

With over 80 members and guests, including all the Society Officers and Mayor Brunton of Springfield present, the 60th Chapter of the ASHAE was officially inaugurated on Thursday, June 2, 1955 at a dinner meeting with President-elect Robert E. Cross presiding.

The charter presentation to the Western Massachusetts Chapter was made by Pres. John E. Haines who extended to the Chapter members greetings and best wishes of the Council for the success of their new Chapter. President Haines in a talk, "The Next Ten Years," predicted that the nation's entire economy and particularly the heating and air-conditioning industry will experience an unprecedented growth during the coming decade. He cited statistics and based his prognostications on the tremendous growth in the nation's industrial plant, construction level and gross national product in the period from 1944 to 1954.

Greetings were also brought to the Chapter from the other Society officers including First Vice Pres. John W. James who briefly described the Society's contributions to research for human comfort; Second Vice Pres. P. B. Gordon who discussed the Chapter's place in the Society; and Prof. E. R. Queer, Treasurer, who outlined for the members some details on the Society's fiscal operations.

Other Society officials present included Council Member R. T. Kern, Fitchburg, Mass.; A. V. Hutchinson, Executive Secretary, and D. T. Donovan, Assistant Secretary.

According to the best available information this is the first time in recent Society history that all four officers have been able to be present for a charter meeting.

President Haines presented the Chapter with a gavel on behalf of the Bluegrass Chapter in Louisville, Ky.

Ten members of the Massachusetts Chapter, including Pres. Geo. W. Sprague and Past-Pres. Arthur L. Hare drove from Boston to attend the Charter Meeting. With a short speech Mr. Hare presented a gavel to the new group from the Massachusetts Chapter.

Other Chapters represented included Connecticut, with 12 members in attendance, Empire State Capital and New York.

Newly elected officers of the Chapter, in addition to Mr. Cross include: J. E. Reed, Vice President; F. A. Ferraro, Secretary; W. A. Boucher, Treasurer; A. M. Lovenberg, K. W. Maki, V. J. Petrolati, Henri Soumerai, and L. C. Lattimer, Jr., Board of Governors.

- *ARIZONA*: Vice Pres. J. P. Sorensen presided at the April meeting. J. B. Hoaglund, chairman of the program committee, introduced the guest speaker, W. O. Stewart, manager, Johnson Service Co., Los Angeles, who gave an interesting discussion on *Modern Trends in Temperature Control*. Attendance 37. Attendance ratio 0.48.

- *ARKANSAS*: By unanimous vote at the April meeting, the Arkansas Chapter year beginning date was changed from December 1 to June 1, with the present officers remaining in office until June 1.

D. T. Donovan, assistant secretary, ASHAE, reported on the Oklahoma City Regional Meeting, the Council report, changes in membership grades and new chapters.

The guest speaker, H. A. Lockhart, vice president and chief engineer, Bell & Gossett Co., Morton Grove, Ill., gave the members the benefit of his many years experience in the field of hot and cold water heating and cooling. He talked on the application of hot water heating using expansion tanks and circulators.

- *ATLANTA*: The following officers were unanimously elected at the April meeting: *President*—T. A. Barrow, Jr.; *Vice President*—F. W. Bull; *Secretary*—J. A. Marshall; *Treasurer*—J. S. Edgar; *Board of Governors*—Jack Crowley and J. M. Lazenby.

Residential Air Conditioning was the subject of the guest speaker, C. W. Nessell, industry consultant, Minneapolis-Honeywell Regulator Co., Chicago. Attendance 44.

- *BALTIMORE*: Pres. E. H. Taze reported in April that an auditing committee had been appointed at the board of governors meeting as follows: C. E. Rice, Jr., R. W. Pentecost and G. V. K. Greene. President Taze read the nominations made by the nominating committee.

A discussion on the interpretation of the chapter by-laws, as to whether a retiring president should automatically serve on the board of governors or be elected to that office, ended with a vote in favor of a motion continuing the by-laws without change.

J. K. Wolford, chairman of the speakers committee, introduced Dr. Ernest Guernsey, whose topic was *Atomic Power*. Dr. Guernsey discussed the need for finding fuel other than coal and oil, because of the increasing demand arising from increased population and because of the increasing difficulty in finding a source of supply of coal and oil. Stating that the cost of nuclear fuel would be approximately the same as existing fuels, Dr. Guernsey said that he expects the first atomic power plant to be in use by 1960.

- *BRITISH COLUMBIA*: *There is Danger in the Air* warned Sam Ross, of CKWX, at the May meeting. Introduced by Pres. S. C. Gale, Mr. Ross, a member of the *Vancouver Clean Air Society*, spoke on air pollution. He felt that the great danger to health and the economic loss caused by smoke, especially when mixed with fog forming smog, makes it imperative that steps be taken to clean the air.

Committee reports included the treasurer's report by R. D. Hale, an encouraging picture of prospective membership by R. A. Malcolm, membership chairman, an announcement of an average 55 percent attendance by E. H. Norton, attendance chairman, and an expression of appreciation to the local newspapers and trade publications for their coverage by A. C. Martin, publicity chairman.

President Gale introduced the following new officers, outlining their duties: *President*—Cornelius Van Boeyen; *Vice President*—D. W. Thomson; *Treasurer*—R. D. Hale; *Secretary*—A. C. Martin; *Board of Governors*—D. M. Drake and D. B. Leaney. Before relinquishing his office to the incoming president, S. C. Gale thanked the past officers and committee chairmen for their help. Attendance 44. Attendance ratio 0.46.

- *BRITISH COLUMBIA*: George Hargraves, British Columbia Electric Co., gave a talk on *Natural Gas for the Lower Mainland of British Columbia* at the April meeting. Pres. S. C. Gale presided.

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*Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

Journal Section

Making an optimistic forecast, Mr. Hargraves said Vancouver would have gas in about one year from the Pacific Northwest Gas Co., coming from Southern California, and in two years from the West Coast Transmission Co. His speech was followed by an interesting question period. Attendance 52. Attendance ratio 0.50.*

• *CENTRAL NEW YORK*: Past Pres. A. L. Jones introduced the speaker in April, Jack Baliff, senior industrial hygiene engineer, New York State Department of Labor, New York, N. Y. Mr. Baliff ably presented his topic, *Industrial Ventilation*. He called attention to the fact that a course in industrial ventilation, which has been given previously from time to time throughout the state, will be given at the University of Buffalo in the fall of 1955. At the end of his talk, Mr. Baliff presented ready and detailed answers to the questions posed.

Since no additional names were presented from the floor, a unanimous ballot was cast for the slate of officers as presented by the nominating committee: *President*—L. A. Childs; *Vice President*—H. J. Morton; *Secretary*—Merle Weninger; *Treasurer*—K. T. Sprague; *Board of Governors*—S. F. Gilman and E. L. Moyer.

Vice Pres. L. A. Childs spoke on the coming annual joint ASHAE-*ASRE* clambake. Attendance 50. Attendance ratio 0.34.

• *CENTRAL OHIO*: Nominating committee and treasurer's report were given at the April meeting. J. D. Slemmons spoke on the Regional Plan of Society Operation. An auditing committee, consisting of W. V. Jones, H. A. Williams and R. A. McGovern was appointed.

The growth of the city of Columbus, Ohio, and its highway plan were covered by John Mackin, Ohio Chamber of Commerce, in an informative talk. Attendance 30. Attendance ratio 0.23.

• *CINCINNATI*: After the business meeting, C. M. Wilson, general sales manager, Anemostat Corporation of America, New York, N. Y., spoke on *High Pressure, High Velocity Air Distribution.*

D. T. Donovan, assistant secretary of the Society, New York, N.Y. commented on the progress of the Committee on Arrangements for the 1956 Annual Meeting in Cincinnati, at the April meeting of the chapter. Pres. F. W. Wilson presided. Attendance 56.

• *CONNECTICUT*: At the joint ASHAE-*ASRE* meeting in April, a tour of the new Hotel Statler in Hartford, Conn., including the equipment section in the basement and the roof, was made in order to inspect the air-conditioing and heating system. Later, following the business meeting, the architect, engineer and contractor for the Hotel Statler spoke on the operation of the building, as well as problems in design.

ASHAE officers were elected at the meeting as follows: *President*—E. J. Hoagland; *Vice President*—Walter Heywood; *Secretary*—J. D. Pierce; *Treasurer*—Fritz Honerkamp; *Board of Governors*—C. L. L'Hommedieu, J. J. Morro and R. B. Cahoon. President L'Hommedieu presented the gavel to the incoming president, Mr. Hoagland. Attendance 106. Attendance ratio 0.34.

• *DELTA*: *Modern Trends in Air Distribution* was the subject of the April guest speaker, W. L. Batchelor, assistant chief engineer, Tuttle & Bailey, Inc., Newington, Conn. Mr. Batchelor gave a thorough discussion of high velocity duct distribution and special diffuser applications for high pressure. His talk was accompanied by many slides and graphic presentations.

Pres. C. V. Bankston read a letter from J. S. Burke, nominating committee chairman, giving the list of those nominated by the committee. Attendance 54. Attendance ratio 0.25.

• *EMPIRE STATE CAPITAL*: At the Ladies Night held in April, Pres. E. C. Doyle, following his welcome to all members and guests, pointed out the advantages of being a member of ASHAE and the Empire State Capital Chapter. He thanked the members and officers for making his year as president succesful. H. S. Bond, chairman, Ladies Night committee, presented President Doyle with his past president's pin, an award from the chapter for a job well done that carried with it the best wishes of all the members. Attendance 197. Attendance ratio 0.86.

• *GOLDEN GATE*: H. A. Lockhart, vice president and chief engineer, Bell & Gossett Co., Morton Grove, Ill. gave an enlightening talk in April on the selection and location of compression tanks for hot water heating systems.

Pres. Eric Roberts appointed a nominating committee, consisting of J. E. Murray, chairman, D. A. Delaney, S. W. Terry, R. W. Sigmund and A. W. Berrier. Plans for the Semi-Annual Meeting were discussed, and an invitation from the Northern California Chapter, *AIA*, to an exhibit of San Francisco Bay Region Architecture was read. Attendance 60.

• *ILLINOIS*: Pres. G. V. Zintel turned the April meeting over to L. H. Streb, of the meetings committee, who introduced R. J. Salinger, air conditioning and ventilating engineer, Naess & Murphy, architects & engineers, Chicago. Mr. Salinger spoke on *Commercial Air Conditioning As Applied to a Large Building*. He took this up from the central system point of view and traced the history of central system air conditioning, outlining its merits and shortcomings. He then proceeded to develop an interesting discussion of the merits and advantages of the various types of low pressure and high pressure air conditioning systems. He said that the design engineer must fully analyze each job, and that even after analysis the best method is not always clean-cut.

At the conclusion of Mr. Salinger's talk, Mr. Streb introduced William Wood, consultant, Philco Corp., Philadelphia, Pa. Mr. Wood discussed air conditioning a large building by means of room coolers. Attendance 147.

• *INDIANA*: *How Ventilation Affects the School Curriculum* was covered in April by P. W. Seagers, professor of education and school building consultant, Indiana University. Dr. Seagers concentrated his talk in the form of a challenge to heating and air-conditioning engineers to enter into more research on schoolroom work, to survey their own practices and to revise them to a more realistic basis. He gave a brief outline of the evolution of ventilation theories and the history of ASHAE influence on the enactment of laws regulating the ventilation of public schools as early as 1900. Expressing belief that we are now on the threshold of air conditioning for schools, Dr. Seagers urged research toward a classroom environment integrally balanced with respect to thermal, acoustic, visual and educational needs. He suggested that a basis for such a balance would be achievement of a condition in which a minimum of body energy would be consumed in adjustment to the environment. This excellent talk was much appreciated by all present.

The report of the nominating committee was given by I. W. Cotton. Pres. P. O. Patterson presided. Attendance 49.

• *INLAND EMPIRE*: L. E. Marque introduced the April speaker, P. L. Geiringer, chief engineer, American Hydrotherm Corp., Long Island City, N. Y. Mr. Geiringer gave the chapter an informative talk on *High Temperature Hot Water* and some of its peculiar characteristics and uses.

Mr. Marque reported the selections of the nominating committee. R. D. Nevers announced that D. H. Knapp and Jack Pearson would join him as ASHAE judges for the Science Fair. Pres. H. A. Bickel presided.

• *IOWA*: Pres. W. E. Nanes at the April meeting introduced J. E. Atkins, who presented an exceptionally informative talk on *A Demonstration of Overall Protection of Electrical Equipment*. Mr. Atkins demonstrated varied equipment available for the type protection he described.

D. T. Donovan, assistant secretary, ASHAE, outlined the organization and purpose of the tentatively proposed Regional Plan of Society Operation.

An auditing committee, composed of G. E. Mellerup, chairman, L. E. Levern and R. R. Schilling, was appointed by President Nanes. The nominating committee report was read by R. H. Schnell, chairman. The committee recommended that standing committee chairmen should also be members of the board of governors, but left such action up to the discretion of the president. Attendance 31.

• *KANSAS*: L. N. Hunter, past president, ASHAE, and vice president in charge of research, The National Radiator Co., Johnstown, Pa., spoke at the April meeting on *The Rating of Heating Boilers.* A. B. Newton, vice president, Kansas Chapter, introduced the speaker.

R. F. Bauer presented a report from the nominating committee regarding election of officers for the 1955-56 term. Attendance 25.

• *KANSAS CITY:* ASHAE Past President, L. N. Hunter, Johnstown, Pa., spoke on *Rating of Heating Boilers* at the April meeting presided over by Pres. F. K. Ladewig. His informative speech was very well received. Attendance 77. Attendance ratio 0.30.

• *MANITOBA*: R. G. Cocker introduced the April speaker, Prof. N. M. Hall, University of Manitoba, who talked on the *Heat Pump* and the sources of heat in the Winnipeg area.

Pres. G. T. Christie called on W. J. Atkinson to present the report of the nominating committee, giving the slate of officers for 1955-56.

• *MICHIGAN*: At the Annual Past Presidents and Ladies Night held in April, 14 past presidents of the Michigan Chapter were introduced. Two of the earliest presidents, W. T. Harms and E. M. Harrigan, were asked to make a few remarks.

The formal meeting was called to order by D. S. Falk, vice president and program chairman. Vice President Falk introduced F. G. Stickel, vice president, Victor Gruen Associates, who spoke on *Shoppers and Shopping.* He presented an illustrated talk on the evolution of the suburban shopping centers, pointing out the economies involved and design problems encountered in meeting the needs of a typical suburban community. Mr. Stickel's talk was of particular interest to the ladies of the audience. Attendance 95. Attendance ratio 0.19.

• *MINNESOTA:* J. E. Haines, ASHAE president, Minneapolis, Minn., spoke on *The Next Ten Years* at the April meeting presided over by Vice Pres. J. S. Locke, in the absence of Pres. J. A. Craig.

Mr. Haines summarized the activity of the Society, as well as the industries involved and what he thought can be expected in progress during the next 10 years. In his talk the speaker mentioned that Minnesota chapter had the largest attendance of any chapter in the Society. Attendance 119.

• *MISSISSIPPI*: At the April meeting of Mississippi Chapter, Pres. J. E. Davis, Jr. asked Burt Lomax, Jr., member of Chapters Conference Committee to report on his committee's meeting in Philadelphia. Discussion of the report followed.

T. E. Stepan introduced the guest speaker, H. E. Degler, technical director, The Marley Co., Kansas City, Mo., who presented an enlightening program on *Re-use of Cooling Water for Air Conditioning.* Attendance 29.

• *MONTREAL*: *Judge* J. P. Fitzsimons presided in April over a session of his court, which consisted of a lively discussion of three cases of installations involving complaints from dissatisfied owners. These three cases were: cold drafts from the window which was heated by a hot water conductor radiator, the inadequate mixing of outside and return air in a ventilation system, and an air-conditioning system which had several major defects inherent in the design and installation. *Judge* Fitzsimons, who in more serious moments is branch manager, Trane Co. of Canada, Ltd., Montreal, meted out fines and bad advice at a rate sufficient to keep everybody on his toes.

During the business part of the meeting, Treas. W. E. Jarvis presented an interim financial report, announcing a substantial surplus. Pres. D. L. Lindsay gave a brief resume of chapter operations during his term and expressed his thanks for cooperation received which helped to make his term happy and successful. President Lindsay was presented a past president's pin and gavel as mementoes of his service.

B. J. Horsburgh, chairman, nominating committee, presented the new executives: *President*—R. J. Ker; *Vice President*—S. R. Plamondon; *Secretary*—W. E. Jarvis; *Treasurer*—Arthur de Breyne; *Board of Governors*—D. L. Lindsay, W. G. Hole, H. G. S. Murray, Robert Clapperton and J. G. Le Francois. Attendance 67.

• *NEBRASKA*: The chairman of the nominating committee, O. J. Smith, at the April meeting gave the recommended nominees for officers for the coming year. As chairman of the by-laws committee, Mr. Smith also gave the report of that committee concerning the adoption of the standard by-laws as recommended by the Council for all chapters. The committee recommended that the standard by-laws be accepted with certain suggested completing phrases. Motions carried the acceptance of these recommendations and arrangements to print and distribute the new by-laws.

M. F. Stober, program chairman, introduced H. E. Degler, technical director, The Marley Co., Kansas City, Mo., who spoke on *Water Cooling Equipment for Refrigeration and Air Conditioning.* From the lengthy question period that followed, Mr. Degler's talk proved to be highly appropriate. Attendance 29.

• *NEW MEXICO*: The slate of new officers was accepted by acclamation at the April meeting. The new slate includes: *President*—H. F. Munn; *Vice President*—C. R. Wherritt; *Secretary*—J. K. James; *Treasurer*—R. W. Haines; *Board of Governors*—R. G. Merryman and F. H. Bridgers.

Secretary James read correspondence from the Albuquerque Chapter of Professional Engineers in regard to a panel discussion to be held this fall. Mr. Bridgers was appointed to this panel.

G. M. Sebree introduced Mr. Meyer, chief engineer, Marlo Coil Co., St. Louis, Mo., who spoke on two stage compressors for residential cooling. Attendance 39. Attendance ratio 0.76.

• *NEW YORK*: The board of tellers, J. P. Lyon, chairman, L. D. Carr and H. N. Seelinger, reported the following election results at the April meeting: *President*—Albert Giannini; *Vice President*—J. B. Hewett; *Treasurer*—W. M. Heebner; *Secretary*—C. H. Flink; *Board of Governors*—C. R. Hiers, W. O. Huebner, J. M. Levy and W. J. Olvany, Jr. R. L. Stinard, as immediate past president, continues to serve on the board of governors for one year.

Mr. Giannini, as program chairman, presented J. D. Pierce, chief engineer, The Vulcan Radiator Co., Hartford, Conn., who spoke on *Year-Round Residential Air Conditioning Using Water.* Mr. Pierce summarized the various types of systems and equipment used primarily for residential air conditioning, and described the various types of units which could be used. He referred to the experimental work being conducted at the University of Illinois for *I=B=R* and explained how a satisfactory residential air-conditioning system could be designed using water as the heating and cooling medium. Attendance 105. Attendance ratio 0.11.

• *NORTH JERSEY*: Elections at the April meeting brought the following results: *President*—C. H. Smith; *Vice President*—W. C. Kruse, Jr.; *Secretary*—M. C. Christesen; *Treasurer*—S. H. Nitzberg; *Board of Governors*—L. G. Huggins, H. P. Morehouse, G. C. Norman and H. M. Patrick.

Mr. Smith introduced C. S. Leopold, consulting engineer, Philadelphia, Pa., who spoke on *Panel Heating.* Hearty applause followed the ensuing discussion. Attendance 80.

• *NORTH TEXAS*: John E. Haines, ASHAE president, Minneapolis, Minn., was introduced as the guest speaker at the April meeting by W. P. Glancy, chairman, program committee. President Haines' talk entitled *The Next Ten Years* was accompanied by statistical projector slides illustrating the growth of home construction, population, power genera-

North Texas Chapter officers meet with ASHAE Pres. John E. Haines (*l.* to *r.*) H. G. Gregerson, vice president, John Ray, chapter president, President Haines, George Meffert, secretary, Ross Zumwalt, treasurer

tion, dollar volume of the industry, membership in ASHAE and Society research for the 1944-54 period. Similar estimates given for the next 10 years were astronomical in relation to present day statistics, posing the need for serious planning.

G. A. Linskie reported on the ASHAE Oklahoma Regional Meeting, and D. C. Pfeiffer, chairman of the chapter technical advisory committee, spoke on the City of Fort Worth ordinance which affects operations of contractors installing heating and air-conditioning equipment.

The Chapter was pleasantly surprised by the attendance at the meeting of J. E. Wilson, who had been unable to attend meetings since being stricken with polio. Attendance 95. Attendance ratio 0.38.

• *NORTHEASTERN OKLAHOMA*: The business meeting in April was presided over by Pres. J. T. McKinney. C. H. Dollmeyer introduced Warner Byars, City of Tulsa Water Department. The meeting was adjourned to the new Tulsa water plant, where an instructive inspection trip was conducted by Mr. Byars and Mr. Dollmeyer. Attendance 21. Attendance ratio 0.38.

• *NORTHERN OHIO*: E. R. Kaiser, ASHAE director of research, Cleveland, Ohio, was introduced in April by J. R. Venning. Mr. Kaiser presented a highly informative talk, covering many phases of the research carried on at the ASHAE Research Laboratory. A lively question period followed.

Elected to the nominating committee were: John Richmond, W. R. Moore and J. M. Black. Attendance 59.

• *NORTHERN PIEDMONT*: The Guide Committee was the subject of W. M. Wallace, II, chairman of that committee, who spoke at the April meeting. C. A. Cofer, program chairman, introduced Mr. Wallace, consulting engineer, Durham, N. C. Pres. S. T. Oliver presided. Attendance 24. Attendance ratio 0.18.

• *OKLAHOMA*: The April meeting was held a few days previous to the Society's Oklahoma Regional Meeting, and, therefore, the meeting was devoted to last-minute plans. W. J. Collins, Jr., general chairman, Committee on Arrangements, reported on reservations. Pres. G. E. Ervin read the names of those who worked to make preparations for the Regional Meeting. The report of the nominating committee was read. Attendance 43.

• *ONTARIO*: At the joint ASHAE-*ASRE* meeting held in April, W. L. Rootham, chairman, papers committee, introduced H. R. Musson as moderator of a panel discussion on air conditioning. B. E. Judges, Joseph Parker and C. M. Wilson spoke on various systems of air conditioning. The question period following the addresses of the panel members proved to be educational.

J. H. Ross, chairman, nominating committee, announced the selected slate of officers for 1955-56. Pres. M. C. Bailey presented an electric table lamp to V. J. Jenkinson as a token of appreciation for his role as chairman of the Conference for Canadian Chapters. Attendance 192.

• *PHILADELPHIA*: *Heating, Ventilation and Air Conditioning Aboard Ships* was the topic of a discussion in April by George Stringfellow, in charge of engineering drafting, and J. Linton, in charge of ventilation and air conditioning, New York Shipbuilding Corp., Camden, N. J. C. J. Lubking, chairman, program committee, introduced the guest speakers.

Officers elected for the 1955-56 term were: *President*—A. M. Robertson: *First Vice President*—C. J. Lubking; *Second Vice President*—P. H. Yeomans: *Treasurer*—C. J. Forve: *Secretary*—R. J. Sigel: *Board of Governors*—J. H. Hucker. Attendance 65. Attendance ratio 0.22.

• *PITTSBURGH*: Featured at the April meeting was a tour of the Gateway Center. This consisted of a visit to KDKA television studio, the inspection of air-conditioning machinery where river water is used for cooling and pumped back to the river, and the inspection of an air filtration system. R. M. Toucey, program chairman, gave a preview of the tour, and A. F. Nass, Jr., introduced the guides. Pres. E. C. Hach presided. Attendance 59.

• *ROCKY MOUNTAIN*: Officers elected at the April annual meeting were: *President*—L. L. DeLong; *Vice President*—A. S. Widdowfield; *Secretary*—W. V. Burbank; *Treasurer*—J. V. Berger; *Board of Governors*—L. V. Davis, D. D. Pearsall and V. F. Vallero.

Speaker at the meeting was W. O. Stewart, manager, Los Angeles office, Johnson Service Co., Los Angeles, Calif. Mr. Stewart made a very informative speech on the developments of pneumatic controls for unit ventilators, and the application of temperature and static controls to high pressure double ducted air distribution systems. A question period followed. Attendance 48. Attendance ratio 0.30.

Northern Piedmont Chapter officers, past and present, meet at Robert E. Lee Hotel, Winston Salem, N.C. (*l.* to *r.*) F. J. Reed, past president, S. T. Oliver, chapter president, J. E. Hart, past president, W. M. Wallace, II, speaker and past president; and C. Z. Adams, Arvin Page, and D. T. Waynick, past presidents; C. A. Cofer, program chairman

• *SACRAMENTO VALLEY*: R. A. Sarro introduced the main speaker at the April meeting, which was held jointly with the Sacramento sub-section of *ASME*. H. A. Lockhart, vice president and chief engineer, Bell & Gossett Co., Morton Grove, Ill., spoke on *Compression Tank Selection for Hot Water Systems*. After discussion of the factors which affect the proper sizing of a compression tank, he displayed a chart which he has developed making allowance for all these factors and giving ease in selection of a tank.

T. E. Brewer, publicity chairman, 1955 Semi-Annual Meeting, spoke briefly on the forthcoming meeting in San Francisco. A motion was passed by the Sacramento Valley Chapter to sponsor the Welcome Tea in San Francisco. F. A. Connolly reported for the nominating committee.

Pres. J. E. Marshall introduced the chairman of the *ASME* group, D. K. Coyle, who spoke on the history of *ASME* and ASHAE, tracing back to *ASCE*. A movie entitled *The Atom Goes to Sea*, the story of the submarine Nautilus, was presented through the courtesy of *ASME*. Attendance 49. Attendance ratio 0.45.

• *SOUTH TEXAS*: ASHAE Pres. John E. Haines, Minneapolis, Minn., gave his predictions for *The Next Ten Years* at the April meeting. Reg. F. Taylor, past president, presented the speaker to his audience.

The nominating committee report was given by C. C. Quin. J. W. Holland presided. Attendance 69.

• *SOUTHERN CALIFORNIA*: J. R. Hall, program chairman, in April introduced K. G. Blessing, district representative, Air Conditioning and Refrigeration Division, Worthington Corp. Mr. Blessing's talk was entitled, *Centralized Built-In Systems for Air Conditioning Existing Multi-Story Buildings*. He reviewed the tremendous potential market in air conditioning existing buildings, outlined the types of applicable systems, and with the aid of slides presented installation and cost data. The questions after the talk showed the interest members had taken in it. Presiding was Pres. C. D. Walz.

The story of the
SEMI-ANNUAL MEETING
and a summary
of the events
will be presented
in the August issue
of the JOURNAL.

• *TOLEDO*: *Principles of Pneumatic Temperature Controls* was the topic developed by H. H. Korff, mechanical engineer, Johnson Service Co., Chicago, Ill., at the April meeting. R. P. Konter introduced the speaker.

Robert Greenwald reported on the participation of the Chapter in the television series sponsored by the University of Toledo. He also presented a motion that an invitation be sent to Council to hold the next regional meeting in Toledo. This passed unanimously.

Pres. F. C. Richardson, Jr. read the slate of nominees for election, and presented D. T. Donovan, assistant secretary, ASHAE, who spoke on the Regional Plan of Society Operation. Attendance 40.

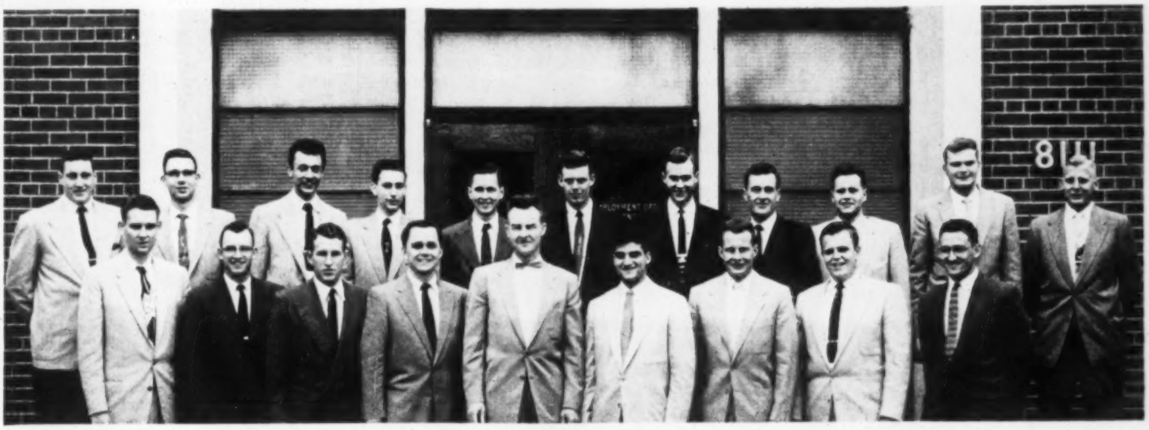
• *WASHINGTON, D. C.*: ASHAE Second Vice Pres. P. B. Gordon, New York, N. Y., introduced at the April meeting by S. H. Robbins, Jr., program chairman, spoke on *Panel Cooling*. The members agreed that his talk was exceptionally well presented. A long question and answer period followed.

Elections held at the meeting brought the following results: *President*—W. C. Reamy, Jr.; *Vice President*—J. H. Broome, *Treasurer*—J. D. Crabtree; *Secretary*—S. H. Robbins, Jr.; *Board of Governors*—G. C. F. Asker, H. W. Rush and J. S. King; *Chapters Conference Committee Member*—P. R. Achenbach; and *Alternate Member*—W. C. Reamy, Jr. Pres. G. C. F. Asker expressed his appreciation to the officers and committees who had worked with him during the year. J. D. Crabtree presented the annual treasurer's report. Attendance 55. Attendance ratio 0.42.

STUDENT BRANCHES

• *OREGON STATE COLLEGE*: The guest speaker at the March 30 meeting, R. C. Chewning, associated with J. Donald Kroeker, consulting engineer, Portland, Ore. was presented to the audience by Pres. P. I. Anderson. Mr. Chewning gave an informative talk on the *Theory and Operation of Heat Pumps*, covering such problems as cost, efficiency, and limitations of heat pump systems. Attendance 14. Attendance ratio 1.00.

• *PURDUE*: A field trip to Detroit, Mich. was made by 20 members of the Purdue University Student Branch and the faculty sponsor, F. B. Morse, assistant professor, School of Mechanical Engineering. The plant tour of American Blower Corp. included inspection of laboratory facilities and manufacturing operations. At Cadillac Motor Car Division, General Motors Corp., the final assembly production line and air conditioning systems put into the cars were viewed. On the second day of the trip, the group drove to the Pontiac Motor Division, General Motors Corp., Pontiac, Mich. where a tour through the foundry, engine assembly department and body stamping shop was made. The students found the trip to be as enjoyable and interesting as any the group has taken. Attendance 20. Attendance ratio 0.61.



Prof. F. B. Morse (*center*) with Purdue student group on a field trip to Detroit, Mich.

Journal Section

Candidates for Membership

The Society's By-Laws require that all applications for membership or advancement are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the Journal of the Society, or mailed to all members. When the replies are received from references the Candidate's application shall be submitted to and acted upon by the Admission and Advancement Committee as soon as possible.

When the Admission and Advancement Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall confirm the election of the proposed Candidate for membership. During the past month there have been 79 applications for membership, including 3 reinstatements; in addition 3 advancements have been received. The names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Admission and Advancement Committee, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by July 30, 1955, these candidates will be voted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

Note: †Reinstatement. *Non-member. △Advancement.

Alabama

Malone, J. C., Jr., Cons. Engr., Birmingham. References: Marvin Crout, E. C. Harper*, F. C. Wood, T. L. Zumbro*.

Arizona

Hight, J. R., Engr., O. K. McCullough Co., Phoenix. References: O. K. McCullough, E. B. Plapp*, H. G. Simmons*, E. W. Steele*.

Wahl, F. E., Cons. Mech. Engr., Phoenix. References: E. P. Boothroyd, V. J. Carns, J. B. Hoaglund, H. E. Kraft.

California

Abrahamson, J. G., Supt., Coon Plumbing & Heating, Lodi. References: Charles Coon*, J. E. Day, M. J. Delavan, Pete Knezevich.

Bowers, J. S., Sales Engr., Westinghouse Electric Corp., Sturtevant Div., San Francisco. References: A. H. Blackwell A. J. Bouey, F. W. Jordan, R. W. Sigmund.

Cavagnolo, L. A., Appl. Engr., Westinghouse Electric Corp., San Francisco, References: A. J. Bouey, J. P. Ernst, F. W. Jordan, R. W. Sigmund.

O'Callahan, E. P., Engr., Health-Aire Heating & Ventilating Inc., Culver City. References: N. N. Dahl, C. R. Kidd, L. R. Kleinberg, C. S. Woods, Jr.

Paldrock, K. K., Engr., James Gayner, Cons. Engr., San Francisco. References: J. C. Beck, Jr., D. A. Delaney, James Gayner, G. J. Yamas.

Sandahl, L. F., Sales Engr., Air Conditioning Supply Co., Los Angeles. References: Clarence Barnes*, C. L. Corbett, Jr., L. B. Davenport, R. L. Huntington.

Skover, R. A., Sales Engr., Natural Gas Equipment, Inc., San Francisco. References: G. E. Brokaw, Herbert Duncan, J. E. Murray, F. L. Nemic.

Ward, J. W., Partner, Edward B. Ward & Co., San Francisco. References: J. C. Beck, Dudley Deane, H. S. Haley, D. E. McLeod.

District of Columbia

Day, I. M., Jr., Partner, Irving M. Day Co., Washington. References: L. G. Humphrey, Jr., J. J. Nolan, Jr., W. G. Reamy, Jr., G. J. Sweeney.

Webster, E. R., Vice Pres., John G. Webster & Sons, Inc., Washington. References: J. J. Chaconas, Sr., A. B. DeVore, V. T. Fahringer, Jr., G. C. Webster.

Illinois

Kaiser, Walter, Sales Engr., H. S. Kaiser Co., Chicago. References: I. B. Kaiser, I. S. Kaiser, J. H. Kaiser, Herbert Kreisman.

McCarthy, W. F., Engrg. Draftsman, Samuel R. Lewis and Assocs., Chicago. References: S. R. Lewis, S. I. Rottmayer, R. W. Shields, F. X. Thale.

Paul, L. O., Vice Pres., Narowetz Heating & Ventilating Co., Chicago. References: W. S. Bodinus, C. W. Deland, E. P. Heckel, S. R. Lewis.

Shaeffer, M. D., Testing & Dvlpt. Engr., Sears Roebuck & Co., Chicago. References: J. S. Hansen, W. A. Lacht*, G. S. MacLeod*, H. N. Ostborg.

Wilson, H. A., Asst. to Property Mgr., Allstate Insurance Co., Skokie. References: R. A. Erickson*, S. R. Jozwiak*, L. M. Russell*, R. J. Somerville.

Indiana

†**Simpson**, A. M., Mgr., Revolving Door Div., International Steel Co., Evansville. References: E. H. Boddy, B. H. Jennings, E. R. Kaiser, W. G. Koch.

Kansas

Herrick, W. D., Dir. Product Design, The Coleman Co., Wichita. References: E. A. Jones, A. B. Newton, Ray Qualley*, Paul Wyckoff*.

Louisiana

Byers, J. E., Repr., Atlas Refrigeration Supplies, Inc., Baton Rouge. References: G. M. Guynn, J. F. Naylor, W. I. Pol, C. S. Woodruff.

△**Sanford**, E. H., Air-Cond. Engr., Cary B. Gamble & Assocs., New Orleans. References: P. E. Coe, Jr., R. K. Goode, W. D. Graham, J. H. Maloney.

Thibedaux, R. P., Mgr., Atlas Refrigeration Supplies, Inc., Baton Rouge. References: W. A. Holland, B. M. Payne, W. I. Pol, C. S. Woodruff.

Wolfe, R. L., Sales Engr., General Heating and Air Conditioning, New Orleans. References: R. K. Goode, W. B. Martin, Jr., Joe Molony*, W. W. Taylor.

Maryland

Morgan, Jack, Mgr., Distributing Sales, Lloyd E. Mitchell, Inc., Baltimore. References: J. H. Baker, W. P. Flanigan, E. H. Taze, R. F. Weisman.

Salmond, W. W., Br. Mgr., York Corp., Baltimore. References: R. E. Dressell, W. G. Robertson, Jr., F. W. VonBehren, J. K. Wolford.

Massachusetts

Hayes, J. F., Pres., Hayes Sales, Inc., W. Springfield. References: E. R. Clement, Sr., Richard Harrington*, George Jelliffe*, K. S. Yeaple*.

Miles, D. W., Vice Pres., Miles Inc., Brockton. References: M. L. Cail, T. S. Hart, J. A. Ivester, R. E. Reid.

Michigan

Dinwiddie, R. S., Jr., Owner, Dinwiddie Sheet Metal Works, Detroit. References: J. S. Blossom, E. J. Green, H. E. Heaton, L. F. Major.

Minnesota

△**Magy**, H. A., Mech. Engr., Gausman & Moore, St. Paul. References: C. E. Gausman, G. F. Gausman, T. G. Gianos, J. W. McNamara.

Mississippi

Williams, J. R., Engr., Burt Lomax, Jr., Jackson. References: L. J. Beasley, W. L. Donald*, Burt Lomax, Jr., F. H. North.

Missouri

Bruce, W. C., Chief Engr., Warren Bruce & Co., St. Louis. References: W. E. Bryan*, E. T. Clucas, H. J. Kipp, H. F. Wilson.

Meers, J. E., Mgr., Htg. Dept., N. O. Nelson Co., St. Louis. References: G. H. Bemarkt, W. D. Braden, B. L. Evans, K. O. Williams.

Montana

Robinson, D. W., Engr., Zonolite Co., Libby. References: Loyd Berg*, R. C. Challender*, E. R. Dodge*, E. R. Schilling*.

Nebraska

Beers, Jack, Archt., Fritz Craig-Jack Beers, Archts., Lincoln. References: L. J. Paulsen, P. J. Pospisil, Verne Simmonds, O. J. Smith.

Brandts, R. W., Repr., D. E. McCulley Co., Omaha. References: W. R. Duffy, C. A. Failor, R. N. Gates, Orville Pratt.

New Jersey

Driscoll, N. J., Chief Engr., Spi-Rol-Fin Corp., Pequannock. References: Fred Attwood*, E. A. Bogucz, R. C. Edwards, Robert Ferry*.

Lackemacher, W. F., Asst. Chief Mech. Engr., Wigton-Abbott Corp., Plainfield. References: J. M. Brown*, Robert Reis, L. H. Roller*, R. H. Wolin.

Marantz, George, Pres., Air Control Engineering Corp., Elizabeth. References: M. S. Frankle, W. F. Raymer, P. H. Werner, Phineas Wintroub.

New York

Lynam, J. P., Chief, Mech. Design Section, Joint Construction Agency, U. S. Corps of Engineers, New York. References: W. J. Biggar, A. J. Hess, Maron Kennedy, W. O. Stewart.

North Carolina

†Burt, R. L., Pres., Mechanical Contractors, Inc., Charlotte. References: A. W. Roth*, L. L. Vaughn*, W. E. Wells*, Frank Wooten, Jr.*

Newberry, A. G., Owner, Glenn Newberry Co., Fayetteville. References: J. T. Hunter, W. B. Shirley*, W. H. Webster, Jr., J. H. Wilkerson.

Thompson, J. W., Jr., Sales Engr., Westinghouse Electric Corp., Charlotte. References: J. R. Clark, M. R. Durlach, F. B. Herty, R. O. McGary.

Ohio

Argo, A. A., Partner, Argo Plumbing Co., Cincinnati. References: A. E. Edwards, I. G. Edwards, K. B. Little, Pinkney Varble.

Frey, J. A., Htg. Engr., Wilbur Watson Assocs., Cleveland. References: C. H. Bales*, B. E. Colwell*, H. V. Wheelock*, J. R. Zawad*.

Haire, A. R., Asst. Mgr., The H. S. Haslett Furnace Co., Columbus. References: A. D. Bogen, F. W. Gurley, N. T. Hess, M. W. Swepston.

Hawk, K. N., Htg. Engr., East Ohio Gas Co., Cleveland. References: R. L. Byers, G. F. Duggan, R. F. Lunt, R. C. Wright.

†Johnson, J. B., Jr., Prod. Engr., Swenson Thermal Research, Inc., Cleveland. References: W. M. Myler, H. E. Staehle, N. W. Stunkard, R. C. Wright.

Roberts, R. E., Sales Engr., East Ohio Gas Co., Cleveland. References: R. L. Byers, R. F. Lunt, R. A. Urban, R. C. Wright.

Stevenson, E. F., Design Engr., Dalton & Dalton, Cleveland. References: Joseph Breslove*, H. L. A. Follenfant, D. R. Harper, Jack White*.

Zillick, P. P., Sales Engr., R. E. Kramig & Co., Inc., Cincinnati. References: R. E. Kramig, Jr., K. B. Little, A. J. Staubitz, F. W. Wilson.

Oklahoma

Cox, J. R., Jr., Mech. Engr., Carnahan & Thompson Engrs., Oklahoma City. References: J. H. Carnahan, W. J. Collins, Jr., F. R. Denham, G. E. Ervin.

Howe, H. K., Partner, Howe-Foster, Inc., Blackwell. References: G. E. Ervin, R. E. Swan, S. S. Webb, L. E. Wickline.

Woodring, W. F., Secy.-Treas., Oklahoma Plumbing & Heating Inc., Enid. References: B. W. Clark, V. W. Miles, J. R. Patten, C. C. Westfall.

Oregon

Bullinger, D. F., Sales Engr., Westinghouse Electric Corp., Air Cond. Div., Portland. References: F. W. Jordan, R. L. Schroeder, W. J. Widmer, W. G. Woolley.

Clute, F. L., Owner, Clute Co., Portland. References: Walter Hanthorne, J. D. Kroeker, W. B. Morrison, E. A. Ponder.

Desch, W. F., Estimator, McCulloch & Sons, Portland. References: L. J. Harrington, H. H. Hewitt, Jr., H. H. Nesbitt, K. R. Murhard.

Pennsylvania

Quinn, V. M., Vice Pres., Quinn Brothers, Inc., Philadelphia. References: J. J. Hucker, Ludwig Mack, W. W. Malloy, A. G. Mutimer.

Vanacore, August, Appl. Engr., Stuart F. Louchheim, Philadelphia. References: Carl Holman*, Sydney Kane, Jr., P. J. Thompson, Carl Woltman*.

Weisenbach, F. W., Htg., Vtg. & Air-Cond. Designer, Howell, Lewis, Shay & Assocs., Philadelphia. References: L. M. Church, Ludwig Mack, S. H. Manheimer, G. E. Tuckerman.

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Spann, B. M., Mfrs. Agent, Greenville. References: M. R. Durlach, Jr., J. E. McMurray, V. A. Morrow, H. H. Powell.

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Goff, J. E., Vice Pres., Ceilheat, Inc., Knoxville. References: P. C. Cromwell*, Stuart Fonde*, Buford Martin*, J. D. Tillman*.

Gulley, W. Q., Pres., Electric Heaters, Inc., Knoxville. References: C. P. Fortner*, J. E. Goff*, F. E. Keener*, E. D. MacArthur*.

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Cook, W. T., Sales Engr., Gustin-Bacon Mfg. Co., Houston. References: E. B. Appling, J. K. Dixon*, Alva Lyons, Jr., J. A. Poole.

Hundley, A. R., Jr., Engr., American Radiator & Standard Sanitary Corp., Dallas. References: J. W. Holland, Bernard Johnson*, Eugene Riehl*, Ross Zumwalt.

Morrison, H. E., Jr., Br. Mgr., Ilg Electric Ventilating Co., Houston. References: R. J. Brentzel, B. P. Fisher, J. J. Friedler, Jr., J. H. Maloney.

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Attwood, J. L., Vice Pres., Beaver Engineering Co., Downsview, Ont. References: Robert Dunn, Nicholas Fodor, W. B. MacIntyre, W. L. Rootham.

Blackhall, W. J., Secy.-Treas., Blackhall Heating and Plumbing Supplies, Ltd., Toronto, Ont. References: M. C. Bailey, William Philip, Charles Torry, H. M. Treleaven.

Day, R. F., Sales Engr., Minneapolis-Honeywell Regulator Co., Ltd., Toronto, Ont. References: W. T. E. Duncan, J. H. Fox, J. D. Grant*, Ivan McDonald.

Hardy, B. M., Sales Engr., Canadian Ice Machine Co., Ottawa, Ont. References: R. H. Dyson, J. W. Green, W. J. Robinson, Bernard Stotesbury.

Krashinsky, David, Chief Engr., Winer & Chazonoff, Inc., Montreal, Que. References: W. D. Adamson, R. J. Bilodeau, R. I. Brasloff, R. I. Douglas.

Low, John, Archt. & Mech. Engr., Architect's Office, Government of British Columbia, Victoria, B. C. References: J. M. Bird, D. B. Leaney, R. G. MacDonald, R. A. Malcolm.

Millar, A. H., Supvsr., Sales & Installation, Walsh & Charles, Ltd., Winnipeg, Man. References: P. L. Charles, Herbert Fox, D. A. Stott, D. S. Swain.

Nadon, Guy, Engr., Letendre, Monti & Assocs., Montreal, Que. References: M. Lefebvre*, T. A. Monti*, R. Tremblay*, P. P. Vinet.

Page, P. E., Mech. Engr., Bechtel, Mannix & Mester, Edmonton, Alta. References: W. W. Barry, B. Brooker*, D. Pannar*, R. G. Proudfoot.

Parker, J. B., Sales Engr., Carrier Engineering, Ltd., Toronto, Ont. References: D. L. Angus, W. L. Rootham, A. E. Stacey, Jr., Charles Torry.

Rempel, George, Owner, Heat Pump, Ltd., Vancouver, B. C. References: Frank Chamberlain, D. M. Drake, Douglas McDonald*, J. H. Taylor.

Woods, W. C., Mgr., Heating Div., J. R. Stephenson, Ltd., Winnipeg, Man. References: W. J. Coates, David Panar, R. G. Proudfoot, K. Siemens.

Zalkind, L. A., Ont. Distr. Mgr., Libby Air Conditioning, Ltd., Toronto, Ont. References: N. J. Dick, R. S. Libby, W. J. McLean, Arthur Nearingburg.

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OBITUARIES

EDWARD L. FOX
Wyoming, Ill.

The Society has received word of the recent death of Edward Louis Fox, 46, in Peoria, Ill. Mr. Fox, a member of ASHAE since 1936, was born in Kokomo, Ind. on September 13, 1908. He attended Peoria public schools and was an electrical engineering graduate from Purdue University in 1936. After graduation, he entered the warm air heating field, working on estimating, layout, sales and purchasing for the American Foundry and Furnace Co., Bloomington, Ill. In 1946, he became associated with the Aldrich Co., Wyoming, Ill., on hot water and steam heating.

He was a member of the Old Timers Club of the *Oil Heat Institute*, the Kewanee Elks Club, and several Masonic lodges. His mother, Mrs. Hazel E. Fox, survives.

HARRY B. MATZEN
West Palm Beach, Fla.

Harry Boyd Matzen, Sr., 70, who retired from Frank A. McBride Co., New York, N. Y. in 1952, died on May 15 after a long illness. At the time of his death, Mr. Matzen was a resident of West Palm Beach, Fla., where he worked as an advisory consultant since he moved from Rockville Centre, N. Y. in 1953. He was recently elected a Life Member of the Society.

Born on July 18, 1884 in New York City, Mr. Matzen attended Stevens Preparatory School and was a graduate of Stevens Institute of Technology in 1907. Following an apprenticeship at Power Specialty Co., Dansville, N. Y., he was employed as a mechanical engineer for the Foundation Co. and in experimental work for International Cigar Machinery Co., both of New York City. In 1916, he joined Carrier Engineering Corp., New York, and in the twenty years he remained in this connection progressed to the position of vice president and member of the board of directors. Previous to entering the employ of Frank A. McBride Co. in 1942, he had acted as a consulting mechanical engineer.

Harry B. Matzen

Surviving are his wife, Mrs. Bessie Matzen; a son, Harry Boyd Matzen, Jr.; and two brothers, Elmer and Otto.

LEO A. TILFORD
Jackson, Mich.

Word has been received from the Western Michigan Chapter of the recent death of Leo A. Tilford, president, Leo A. Tilford Co., Jackson, Mich. A sales engineer, Mr. Tilford did layout of control systems, supervised installations and gave advice on control problems.

Mr. Tilford was born in Eaton Rapids, Mich. on October 8, 1897. He studied at Eaton Rapids High School and Michigan State College, East Lansing, Mich. From 1920-26 he was connected with Holland Furnace Co., Jackson, Mich. Following this, he acted as a factory distributor in Michigan for Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

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*Member of Committee on Research.

ASHAE — OFFICERS OF CHAPTERS AND BRANCHES

(60 Chapters; 1 Special Branch; 8 Student Branches)

Date indicates year organized; an address and no city shown signifies same city as headquarters; numeral in parentheses indicates zone.

● **ARIZONA:** 1953. Hdqrs., Phoenix. Meets, 1st Mon. PRES., W. A. Biddle, 3817 N. 15th Ave. SECY., E. P. Maxwell, 39 W. Adams St.

● **ARKANSAS:** 1952. Hdqrs., Little Rock, Ark. Meets, 3rd Tues. PRES., W. J. Franklin, 608 W. Third St. SECY., J. W. Thompson, 1314 Main St.

● **ATLANTA:** 1937. Hdqrs., Atlanta, Ga. Meets, 2nd Mon., PRES., T. A. Barrow, Jr., 735 Spring St., N.W. SECY., J. A. Marshall, 1415 Howell Mill Rd., N.W.

● **BALTIMORE:** 1949. Hdqrs., Baltimore, Md. Meets, 3rd Wed. PRES., E. H. Taze, 33 E. 21st St. (18). SECY., R. F. Weisman, 4650 Reisterstown Rd. (15).

● **BLUEGRASS:** 1954. Hdqrs., Louisville, Ky. Meets, 2nd Mon. PRES., J. W. May, 215 Central Ave. SECY., A. E. Hausmann, 227 Lowell Ave., Charlestown, Ind.

● **BRITISH COLUMBIA:** 1952. Hdqrs., Vancouver, B.C., Canada. Meets, 2nd Wed. PRES., Cornelius Van Boeyen, 636 Drake St. (3). SECY., A. C. Martin, 425 W. Second Ave.

● **CENTRAL NEW YORK:** 1944. Hdqrs., Syracuse, N. Y. Meets, 4th Wed. PRES., F. D. Putnam, 115 Pulsifer Dr., Auburn. SECY., Merle Weninger, 230 Goodrich Ave. (5).

● **CENTRAL OHIO:** 1944. Hdqrs., Columbus, Ohio. Meets, 3rd Mon. PRES., J. A. Guy, 478 W. Fifth Ave. (1). SECY., W. A. Schoonover, 2901 N. High St. (2).

● **CINCINNATI:** 1932. Hdqrs., Cincinnati, Ohio. Meets 1st Tues. PRES., A. H. Gerdsen, 224 E. Second St. (2). SECY., T. D. Reiley, 1905 Dunlap St. (14).

● **CONNECTICUT:** 1940. Hdqrs., New Haven, Conn. Meets, 3rd Thurs. PRES., E. J. Hoagland, 257 Whitney St., Hartford. SECY., J. D. Pierce, 775 Capitol Ave., Hartford.

● **DELTA:** 1939. Hdqrs., New Orleans, La. Meets, 3rd Tues. PRES., W. B. Martin, Jr., 635 Commercial Pl. (12). SECY., R. K. Goode, 3613 Pine St. (25).

● **EMPIRE STATE CAPITAL:** 1951. Hdqrs., Albany, N. Y. Meets, 2nd Wed. PRES., L. V. Appleby, Maple Ave., Altamont. SECY., E. J. Mahoney, 45 Colvin Ave.

● **GOLDEN GATE:** 1937. Hdqrs., San Francisco, Calif. Meets, 1st Thurs. PRES., D. E. McLeod, 2415 Green St. (23). SECY., Herb Duncan, 938 N. Linden Ave.

● **ILLINOIS:** 1906. Hdqrs., Chicago, Ill. Meets, 2nd Mon. PRES., G. G. Freyder, 72 W. Adams St. (90). SECY., Herbert Kreisman, 117 N. Desplaines St. (6).

● **INDIANA:** 1943. Hdqrs. Indianapolis, Ind. Meets, 4th Tues. PRES., J. W. Jackson, 1531 N. Pennsylvania St. (2). SECY., G. W. Vogel, 31 E. Georgia St. (4).

● **INLAND EMPIRE:** 1950. Hdqrs., Spokane, Wash. Meets, 1st Mon. PRES., F. W. Jenkinson, 228 Hutton Bldg. SECY., J. A. Doyle, W. 3018 Broad.

● **IOWA:** 1940. Hdqrs., Des Moines, Ia. Meets, 2nd Tues. PRES., G. J. Kraai, 907 Sixth Ave. (14). SECY., W. A. Schworm, Physical Plant Dept., Iowa State College, Ames.

● **KANSAS:** 1951. Hdqrs., Wichita, Kan. Meets, Tues. after 1st Mon. PRES., Charles Yoe, P.O. Box 2239. SECY., T. L. Roberts, 2008 S. Parkwood Lane.

● **KANSAS CITY:** 1917. Hdqrs., Kansas City, Mo. Meets, 1st Mon. PRES., A. S. Hurt, Jr., 2119 Washington St. (8). SECY., S. C. McCann, 210 W. Tenth St. (5).

● **MANITOBA:** 1935. Hdqrs., Winnipeg, Man., Canada. Meets, 4th Thurs. PRES., G. T. Christie, Midland & Notre Dame. SECY., A. J. McIntyre, 935 Garwood Ave.

● **MASSACHUSETTS:** 1912. Hdqrs., Boston Mass. Meets, 3rd Tues. PRES., G. W. Sprague, 108 Cummington St. SECY., W. G. Burbo, 137 Newbury St. (16).

● **MEMPHIS:** 1944. Hdqrs., Memphis, Tenn. Meets, 3rd Mon. PRES., A. W. Shelby, 972 Union Ave. SECY., A. T. Bevil, 1638 Union Ave. (4).

● **MIAMI VALLEY:** 1950. Hdqrs., Dayton, Ohio. Meets, 1st Wed. PRES., R. W. Kimmel, 320 Loneworth St. (2). SECY., J. B. Rishel, 656 Selma Rd. (9).

● **MICHIGAN:** 1916. Hdqrs., Detroit, Mich. Meets, 1st Mon. after 10th of month. PRES., D. S. Falk, 4864 Woodward Ave. (1). SECY., J. H. Spitzley, 1200 W. Fort St. (26).

● **MINNESOTA:** 1918. Hdqrs., Minneapolis, Minn. Meets, 1st Mon. PRES., J. S. Locke, 2753 Fourth Ave., S. (8). SECY., F. G. Vogt, 6530 W. Lake St. (16).

● **MISSISSIPPI:** 1953. Hdqrs., Jackson, Miss. Meets, 4th Mon. PRES., J. E. Davis, Jr., P.O. Box 3216, West Jackson (7). SECY., L. H. Smith, 711 W. Capitol St.

● **MONTREAL:** 1936. Hdqrs., Montreal, Que., Canada. Meets, 3rd Mon. PRES., R. J. Ker, 5000 Namur St. (9). SECY., W. E. Jarvis, P.O. Box 61.

● **NEBRASKA:** 1940. Hdqrs., Omaha, Neb. Meets, 2nd Tues. PRES., C. A. Goth, Omaha National Bank Bldg. (2). SECY., L. J. Paulsen, 1901 S. 39th St.

● **NEW MEXICO:** 1954. Hdqrs., Albuquerque, N. M. Meets, 3rd Mon. PRES., H. F. Munn, 419 Granite, N.W. SECY., J. K. James, 4462 Avenida del Sol.

● **NEW YORK:** 1911. Hdqrs., New York, N. Y. Meets, 3rd Mon. PRES., Albert Giannini, 385 Madison Ave. (17). SECY., Carl H. Flink, 62 Worth St., (13).

● **NORTH JERSEY:** 1952. Hdqrs., Newark, N. J. Meets, 2nd Tues. PRES., C. H. Smith, 2300 N. Stiles St., Linden. SECY., M. C. Christesen, 196 Everett Pl., Englewood.

● **NORTH TEXAS:** 1938. Hdqrs., Dallas, Tex. Meets, 3rd Mon. PRES., J. A. Ray, 4411 Belmont Ave. (4). SECY., G. H. Meffert, 3328 Greenbrier Dr. (5).

● **NORTHEASTERN OKLAHOMA:** 1948. Hdqrs., Tulsa, Okla. Meets, 2nd Tues. PRES., J. T. McKinney, P.O. Box 5145 (16). SECY., G. A. McCune, 1908 Utica Square.

● **NORTHERN OHIO:** 1916. Hdqrs., Cleveland, Ohio. Meets, 2nd Mon. PRES., L. C. Burkes, 1792 E. 40th St. SECY., R. A. Urban, Sr., 1740 E. 12th St. (14).

● **NORTHERN PIEDMONT:** 1952. Hdqrs., Greensboro, N. C. Meets, 2nd or 3rd Fri. PRES., S. T. Oliver, 2307 Fairfield Ave. SECY., E. D. Frazier, 320 Ashland Dr.

● **OKLAHOMA:** 1935. Hdqrs., Oklahoma City, Okla. Meets, 2nd Mon. PRES., G. E. Ervin, 2800 N. Oklahoma St. (5). SECY., F. R. Denham, 320 Oklahoma Natural Bldg.

● **ONTARIO:** 1922. Hdqrs., Toronto, Ont., Canada. Meets, 1st Mon. PRES., M. C. Bailey, 1139 Bay St. SECY., H. R. Roth, 57 Bloor St., W.

● **OREGON:** 1939. Hdqrs., Portland, Ore. Meets, Thurs. after 1st Tues. PRES., Dick Blankenship, Cascade Bldg. (4). SECY., W. B. Hayes, 707 Portland Trust Bldg. (4).

● **OTTAWA VALLEY:** 1952. Hdqrs. Ottawa, Ont., Canada. Meets, 3rd Tues. PRES., E. J. Schownherr, 32 Clarey Ave. (1). SECY., D. W. Banton, 360 Richmond Rd. (3).

● **PACIFIC NORTHWEST:** 1928. Hdqrs., Seattle, Wash. Meets, 2nd Tues. PRES., P. I. L. Winsor, 20031 Marine View Dr., S.W. (66). SECY., M. W. McKinstry, 4017 McGilvra St. (2).

● **PHILADELPHIA:** 1916. Hdqrs., Philadelphia, Pa. Meets, 2nd Thurs. PRES., A. M. Robertson, 1200 Locust St. (7). SECY., R. J. Sigel, 6 Hampden Ave., Narberth.

● **PITTSBURGH:** 1919. Hdqrs., Pittsburgh, Pa. Meets, 3rd Mon. PRES., C. L. Benn, 420 Blvd. of Allies (19). SECY., E. H. Riesmeyer, Jr., 231-33 Fort Pitt Blvd. (22).

● **ROCKY MOUNTAIN:** 1944. Hdqrs., Denver, Colo. Meets, 1st Wed. PRES., L. L. DeLong, 2027 S. Washington St. (10). SECY., W. V. Burbank, P.O. Box 840.

● **SACRAMENTO VALLEY:** 1952. Hdqrs., Sacramento, Calif. Meets, 1st Wed. PRES., R. A. Sarro, 5412 Argo Way (21). SECY., M. J. Delavan, 405 Meister Way (19).

● **ST. LOUIS:** 1918. Hdqrs., St. Louis, Mo. Meets, 2nd Tues. PRES., E. T. Clucas, 4354 Olive St. SECY., N. J. Hubbuch, Jr., 3847 Shaw Blvd. (10).

● **SHREVEPORT:** 1948. Hdqrs., Shreveport, La. Meets, 3rd Thurs. PRES., J. S. Malahy, Jr., 1839 Line Ave. SECY., H. E. Scott, 2502 Woodford St.

● **SOUTH CAROLINA:** 1954. Hdqrs., Columbia, S. C. PRES., R. K. Rouse, P.O. Box 3731, Greenville. SECY., B. A. Leppard, P.O. Box 3294, Station "A," Greenville.

● **SOUTH TEXAS:** 1938. Hdqrs., Houston, Tex. Meets, 3rd Fri. PRES., J. W. Holland, 245 Esperson Bldg. (2). SECY., J. C. Lewis, Box 8188.

● **SOUTHERN CALIFORNIA:** 1930. Hdqrs., Los Angeles, Calif. Meets, 1st Tues. PRES., C. D. Walz, 3600 San Pasqual St., Pasadena (10). SECY., H. F. Ulovec, 3886 Olympiad Dr. (43).

● **SOUTHERN PIEDMONT:** 1952. Hdqrs., Charlotte, N.C. PRES., L. F. Lawrence, Jr., 212 Greystone Rd. SECY., G. C. Garrett, P.O. Box 3697.

● **SOUTHWEST TEXAS:** 1946. Hdqrs., San Antonio, Tex. Meets, 3rd Tues. PRES., F. B. Frazee, 1013 Riverside Dr., Austin (4). SECY., J. L. Rea, Jr., 300 West 8th St., Austin.

● **TOLEDO:** 1954. Hdqrs., Toledo, Ohio. PRES., C. F. Hoffman, 523 Spitzer Bldg. (4). SECY., R. I. Fruth, 1316 Adams St. (2).

● **UTAH:** 1944. Hdqrs., Salt Lake City, Utah. Meets, 3rd Thurs. PRES., A. A. Maycock, P.O. Box 36 (10). SECY., W. L. Stuewe, 1472 S. State St. (4).

● **VIRGINIA:** 1946. Hdqrs., Norfolk, Va. Meets, 3rd Wed. PRES., T. B. Carpenter, 8400 Millard St. SECY., C. G. Conaway, Jr., 4701 Colley Ave. (5).

● **WASHINGTON, D. C.:** 1935. Hdqrs., Washington, D. C. Meets, 2nd Wed. PRES., W. C. Reamy, Jr., 720 Mills Bldg. (6). SECY., S. H. Robbins, Jr., 2009 K St., N.W.

● **WEST TEXAS:** 1953. Hdqrs., Lubbock, Tex. Meets, 1st Tues. PRES., R. S. Carow, P.O. Box 3206. SECY., H. L. Mayes, P.O. Box 151.

● **WESTERN MASSACHUSETTS:** 1955. Hdqrs., Springfield. PRES., R. E. Cross, 114 Boston Rd. SECY., F. A. Ferraro, 172 Chestnut St.

● **WESTERN MICHIGAN:** 1931. Hdqrs., Grand Rapids, Mich. Meets, 2nd Mon. PRES., F. W. Brundage, 512 N. Park St., Kalamazoo (11). SECY., F. L. Murray, 482 W. Michigan Ave., Battle Creek.

● **WESTERN NEW YORK:** 1919. Hdqrs., Buffalo, N. Y. Meets, 2nd Mon. PRES., C. W. Kaupp, 271 Delaware Ave. (2). SECY., J. P. Guerra, 96 Cottage St. (1).

● **WISCONSIN:** 1922. Hdqrs., Milwaukee, Wis. Meets, 3rd Mon. PRES., I. J. Rossiter, 231 W. Wisconsin Ave. (3). SECY., R. D. Rodwell, 4781 N. Elkhart Ave. (11).

SPECIAL BRANCH

● **SWITZERLAND:** 1952. Hdqrs., Zurich. PRES., H. C. Bechtler, Anemonenstrasse 40 (47). SECY., Walter Hausler, Erbstrasse 2, Kusnacht.

STUDENT BRANCHES

● **NORTH CAROLINA STATE COLLEGE:** 1948. Hdqrs., Raleigh, N. C. PRES., Alvah Ehrman, Box 4502, State College Station. SECY., R. W. McDonald, 1010½ Vance St.

● **OKLAHOMA A. & M. COLLEGE:** 1950 Hdqrs., Stillwater, Okla. PRES., C. E. Durrett, 1215 College. SECY., R. M. Jauch, 308½ W. Maple.

● **OREGON STATE COLLEGE:** 1949. Hdqrs., Corvallis, Ore. Meets, 1st Wed. after 1st Tues. PRES., P. I. Anderson, 202 N. 10th. SECY., D. W. Strahan, 233 Mall St.

● **PURDUE UNIVERSITY:** 1948. Hdqrs., W. Lafayette, Ind. PRES., D. B. Doucette, Purdue Student Branch, ASHAE, School of Mech. Engrg. SECY., J. W. Deabler, Purdue Student Branch, ASHAE, School of Mech. Engrg.

● **TEXAS A. & M. COLLEGE:** 1946. Hdqrs., College Station, Tex. Meets, 2nd and 4th Tues. PRES., D. F. Carroll, Box 6264. SECY., C. W. Farrar, Jr., Rt. 1, Box 339, Bryan.

● **UNIVERSITY OF DETROIT:** 1949. Hdqrs., Detroit, Mich. Meets, 1st Tues. PRES., J. C. Rumpf, 16511 Muirland (21). SECY., L. J. Hayes, Jr., University of Detroit.

● **UNIVERSITY OF TEXAS:** 1949. Hdqrs., Austin, Tex. Meets, 1st and 3rd Tues.

● **UNIVERSITY OF TORONTO:** 1951. Hdqrs., Toronto, Ont., Canada. PRES., W. A. Stewart, 86 Roxborough St., W. (5). SECY., R. M. Davies, 144 Manor Rd., E.

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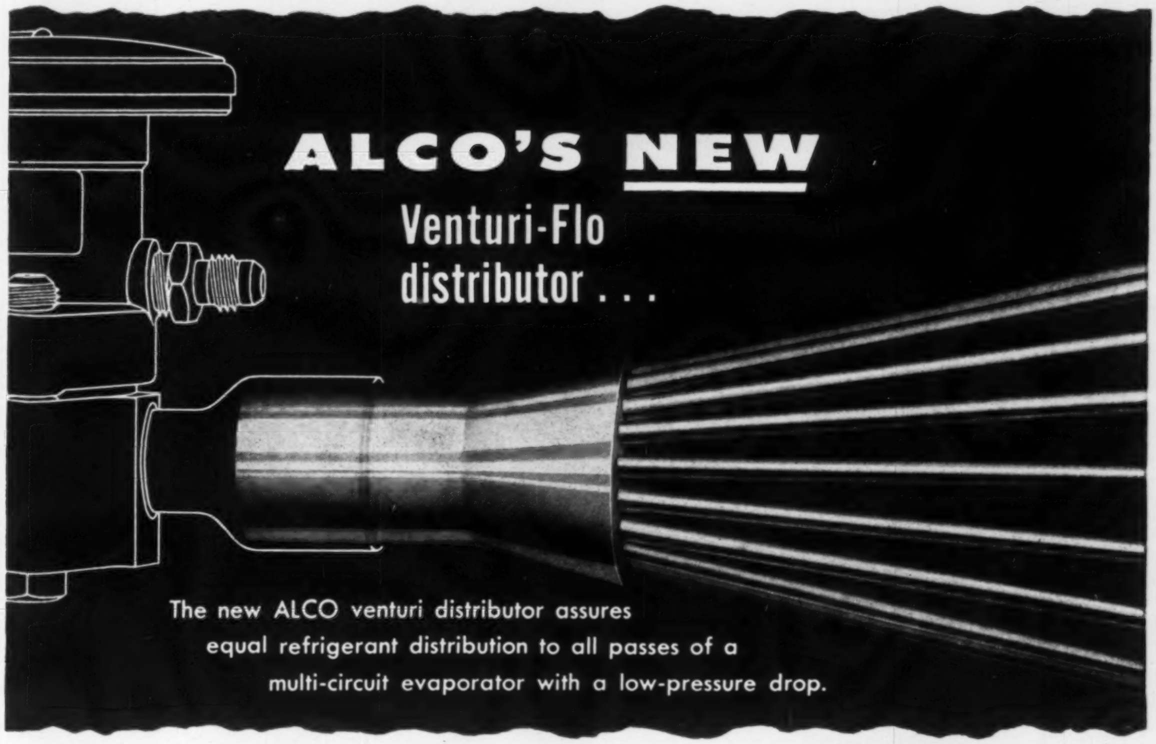
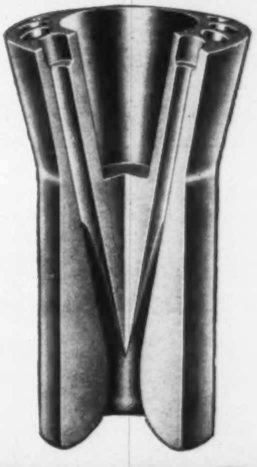


ALCO'S NEW
Venturi-Flo distributor . . .

The new ALCO venturi distributor assures equal refrigerant distribution to all passes of a multi-circuit evaporator with a low-pressure drop.



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vertical, upside-down or horizontal.

wide application range

from 25% of capacity to 150% of rated capacity . . . with only a small pressure drop at maximum conditions.

low-pressure drop

allows closer and more economical thermo-valve sizing.

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no nozzles for capacity regulation . . . nothing to take apart, nothing to come apart.

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BOX SCORE

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ADSCO PISTON-RING EXPANSION JOINT

PIPING ENGINEERS—Check these points on your score pad!

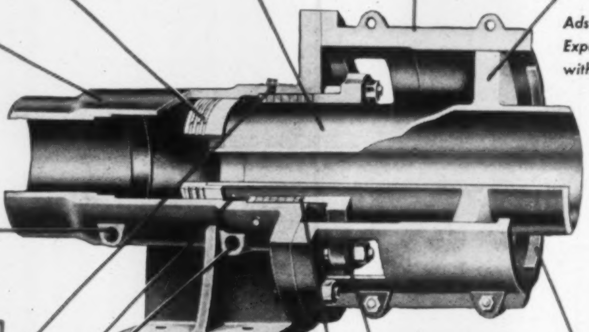
PISTON RINGS seated in internal guide ring hold line pressure during unpacking and repacking operation. Internal guide ring is attached to inner end of slip. It moves inside bored cylinder of body, guiding slip accurately. It also acts as limit stop to prevent slip from being pulled out of body. Guide ring and packing prevent polished surface of slip from contacting any metal and thus protect it from becoming scratched or scored.

EXTERNAL GUIDE is a bored cylinder, rigidly attached to body, and guides slip flange at outer end of slip. Openings in guide permit easy access to packing gland studs. Guide is built in two halves to reduce size of manholes. Made of semi-steel for operating temperatures to 750 F, annealed cast steel above 750 F.

SLIP of chromium-plated seamless steel, with steel flange welded to it, is standard construction for all sizes of both semi-steel and fabricated steel joints. VanStone slips of cast bronze or chromium-plated seamless steel can be furnished at additional cost.

SLIP FLANGE of flanged-end joint has outside diameter greater than that of pipe flange to which it is to be bolted. Sliding surface of slip flange is machined to insure accurate guiding.

BODY is cast semi-steel in the 125 lb. and 250 lb. series; fabricated steel in the 150 lb., 300 lb. and 400 lb. series. Bodies are stress relieved for operating temperatures over 650 F. Cast steel bodies are furnished on special order only. Machined cylinders of body and external guide provide rigid, axial guiding of slip.



Adsco Piston-Ring Expansion Joint with Welding Ends.

DRIP CONNECTION is drilled and tapped when so specified.

LUBRICATION FITTINGS will be furnished, if so ordered. Otherwise, holes for lubrication fittings are tapped and plugged.

BASE, to support joint or serve as intermediate anchor, is drilled with 4 bolt holes. Anchor base for end anchor can be furnished.

LIP on external guide acts as secondary limit stop to prevent slip from being pulled out of body. Relief in lip prevents accumulation of foreign particles.

RELIEF CHAMBER AND VENT opening exhaust the steam which passes piston rings during unpacking and repacking operation, thereby relieving stuffing box area from all pressure and causing piston rings to seal. A nipple and valve should be connected to vent opening so that steam pressure on the packing is relieved before gland is loosened.

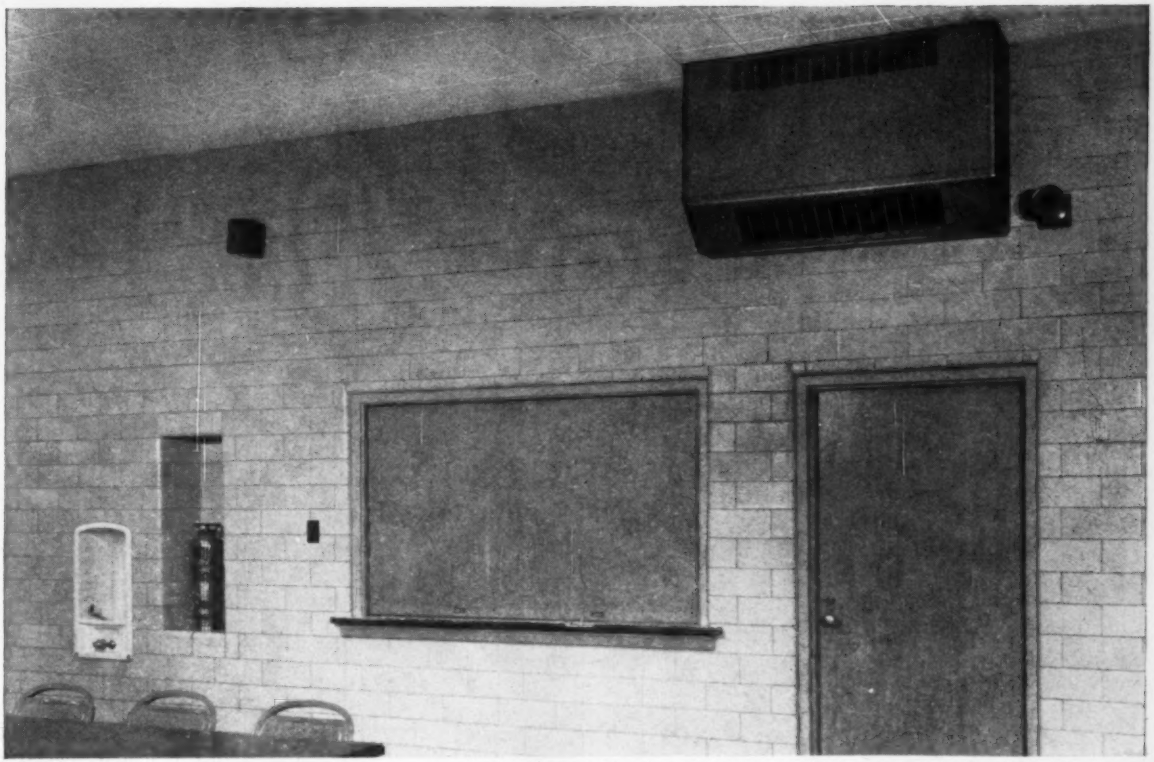
STUFFING BOX is proportioned in depth and diameter to provide proper packing space for resiliency of packing and tightness of joint.

GLAND is semi-steel for operating temperatures to 750 F, annealed cast steel above 750 F. Studs are carbon steel with cadmium-plated nuts for temperatures to 750 F. Both studs and nuts are alloy steel for use above 750 F.

Write for Bulletin 35-51

ADSCO LEADERSHIP SINCE 1877

AMERICAN DISTRICT STEAM DIVISION
ADSCO INDUSTRIES, INC.
NORTH TONAWANDA, NEW YORK
PLANTS: BUFFALO, N. Y.—NORTH TONAWANDA, N. Y.—RICHMOND, CALIF.



Dunham Vari-Temp Cabinet inverted on the wall of St. Bartholomew School, Chicago, Ill. Architect: Barry and Kay, Chicago, Ill. Heating Contractor: Northwestern Heating & Plumbing Co., Evanston, Ill.

How to heat and cool with just one unit... DUNHAM VARI-TEMP

Install Dunham all-weather Vari-Temp® and you have *more* than a heating system . . . *more* than a cooling system. You have *both* . . . and with *just one unit.*

Dunham Vari-Temp is a simple solution for your clients who want year-round air-conditioned comfort in their buildings but can't afford costly space-using central system ductwork. Vari-Temp eliminates ducts since a single riser can supply hot water for heating, chilled water for cooling to each unit.

Individual Room Control. Dunham Vari-Temp Units heat, cool, ventilate, filter and dehumidify air on a *room-by-room basis*—an ideal setup for hotels, motels, hospitals, apartments, offices and other multiroom applications.

Versatile Vari-Temp not only heats and cools with water, but also heats with steam. Furthermore, you can mount this newly expanded line of comfort conditioning, double-duty cabinets on the floor, walls or ceiling . . . fully or partially recessed . . . or even completely conceal them.

For all the facts about all-weather Vari-Temp, clip and mail the coupon.

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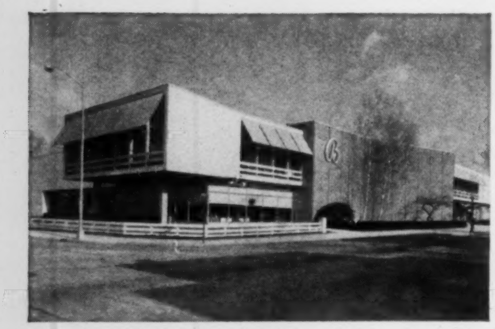


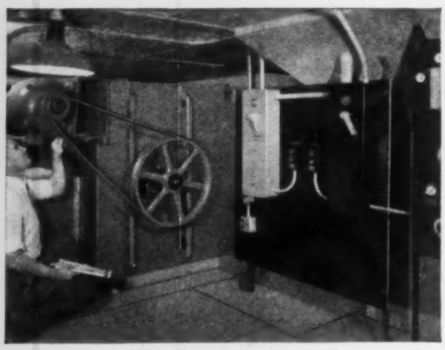
Bloomingdale's new California-styled department store, Stamford, Conn. General contractors: The Austin Co.; consulting engineer: Edward Ashley—both of New York.

Inside, American Blower equipment is quiet-operating; no distracting "machinery" noises to annoy customers.

Louis D'Orso of Richards & Jessup Co., Stamford, Conn., says: "Thanks to American Blower, we were able to meet Bloomingdale's 120-day deadline."

Air conditioning: from blueprint to Bloomingdale's in just 120 days!

American Blower helps contractor meet unusual installation deadline



Eighteen American Blower Supply and Exhaust Fans are housed in concealed, soundproof rooms; recirculate cooled (or warmed), dehumidified air—with seven air changes per hour. System also includes: 28 Venturafin Unit Heaters, Heating and Cooling Coils.

Richards & Jessup Co. – air-conditioning contractors – had a tough assignment. Starting from blueprints in March, they were to install an air-conditioning system in Bloomingdale's Stamford, Conn. department store and have equipment on the job *by July!*

"American Blower did an excellent job of furnishing equipment for Bloomingdale's air-conditioning system," reports Louis D'Orso, Richards & Jessup superintendent. "This was no ordinary job. American Blower had to tailor-make and ship the equipment – and we had to install it – all within 120 days!

"We made it all right – thanks to American Blower's exceptional service. Their representatives were in and out of here constantly, seeing to it that every piece of equipment met specifications exactly. We believe service like this, plus American Blower quality and price, are hard to beat."

If *your* plans include an air-conditioning or air-handling system, call your American Blower or Canadian Sirocco Branch Office – and talk over the benefits and economies of American Blower equipment with one of our experienced representatives.

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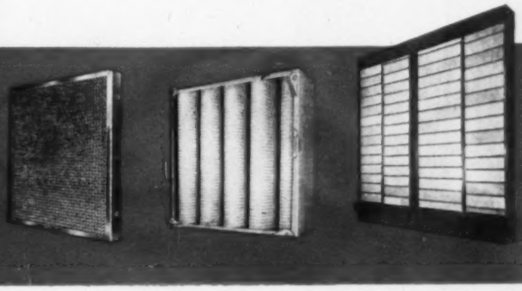
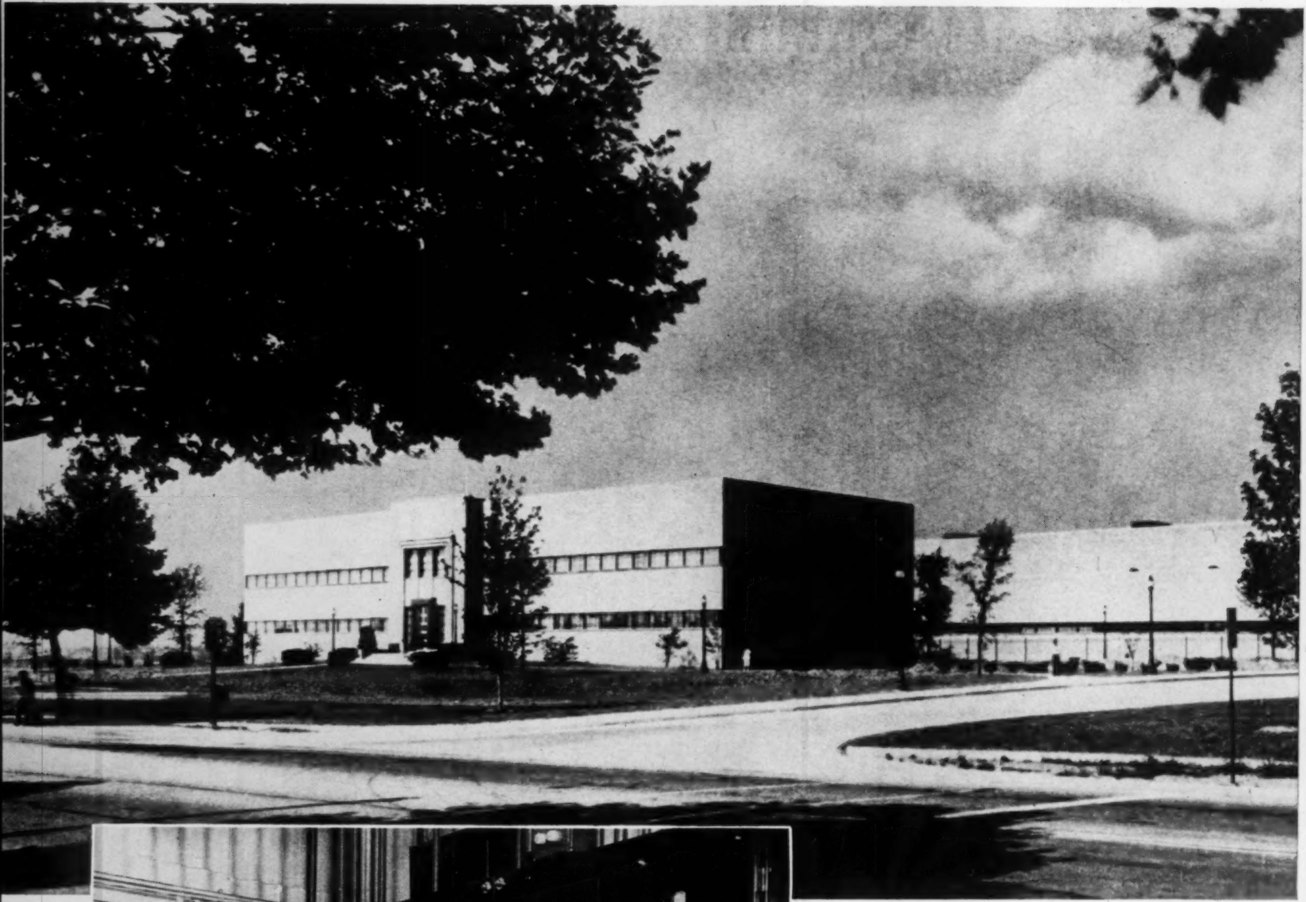
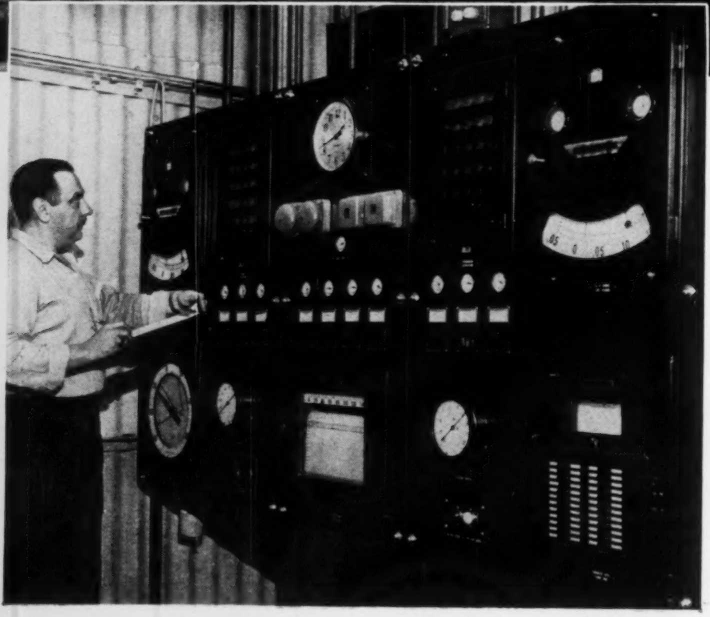


Vital data for big air-handling

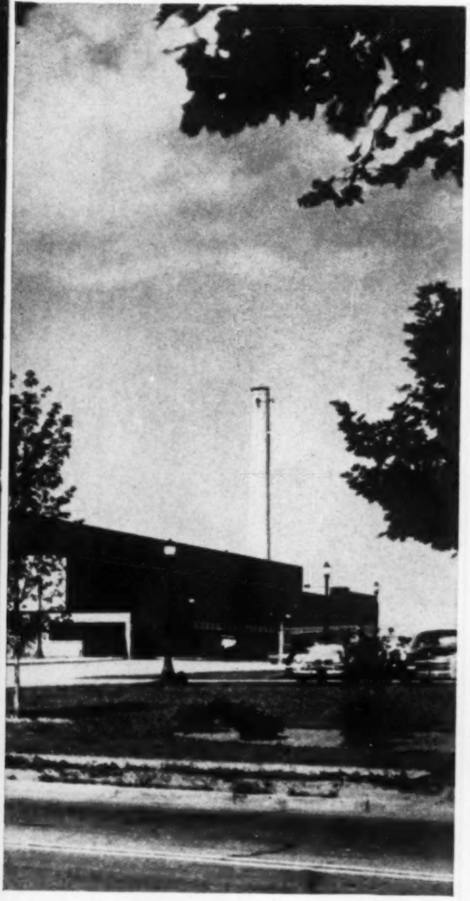




CONTROLLED CLIMATE PROTECTS PRECISION. *Allentown, Pa. plant of Western Electric Company profits by accurately controlled air temperature and humidity . . . for maintenance of freedom from dirt, dust and perspiration that could damage delicate electronic components.*

AIR HANDLING CONTROL CENTER. *Brown instruments on this main control panel provide fingertip control of static air pressure within the buildings, control of intake and recirculation dampers, and a ready check on temperatures in plant areas and of outside atmosphere.*

system centralized



by Brown instruments

EFFICIENT overall supervision of an air handling system is a process control problem . . . for which Brown instrumentation offers an effective solution.

Here's a typical example of how this idea works. At the ultra-modern electronics plant of Western Electric Company, Allentown, Pa., four different manufacturing areas require close control of air temperature and humidity in order to assure consistently high quality of production. Two office areas are also air conditioned.

The manufacturing and office areas are divided into nineteen units, each supplied by its own air handling system and independently controlled by Honeywell thermostats in hot and cold ducts, *Grad-U-Stats* and *Humidistats* in individual zones within the area, and pneumatically operated steam and cooling water valves.

To supplement the on-the-spot area controls, a panel of Brown instruments gives the plant engineer a concentrated picture of the operation of the entire plant's air conditioning. At a glance, he can see outside air temperatures, both wet and dry bulb . . . continuously recorded on a wide chart. He can spot-check up to 48 different inside temperatures, just by pressing push-buttons. And for overall operation, he has a pair of Brown controllers for regulating static pressure within the buildings, and an *ElectroniK* controller for adjusting fresh air intake and recirculation dampers.

The accurate, centralized way in which this vital data is displayed makes for maximum efficiency in supervision . . . maximum economy in use of steam, water and power.

Any air handling system can reap these same benefits through the application of Brown instruments. The range of instrument types and ranges covers any variable encountered in modern system operation . . . temperature, humidity, pressure, flow . . . in a variety of indicating, recording and controlling functions. All are developed, manufactured and custom-engineered by Honeywell . . . the world's largest manufacturer of controls. You profit by this single responsibility for *all* control needed throughout the entire installation.

For a discussion of how these instruments can centralize control in your specific system, call your local Honeywell sales engineer . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

H
HONEYWELL

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS

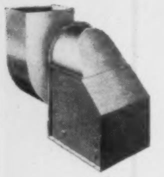
First in Controls

● **REFERENCE DATA: Write for Catalog S1810A, "Brown Instruments Applied to Commercial Air Handling Systems."**

The MASSACHUSETTS *Line*®

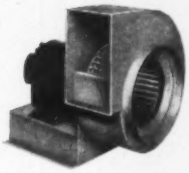
FULL
MEMBER
N.A.F.M.

in performance



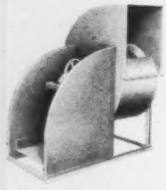
Series MSV—Design 2 Belt Driven—Ten Sizes, 7½" to 27" Wheel Diameter.

Type "S" Direct Driven—Eight Sizes, 6¼" to 13½" Wheel Diameter.

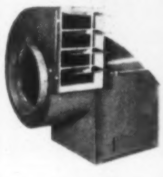


UTILITY TYPE VENTILATING SETS

Series MSV
Design 3
Belt Driven
30" Wheel
Diameter

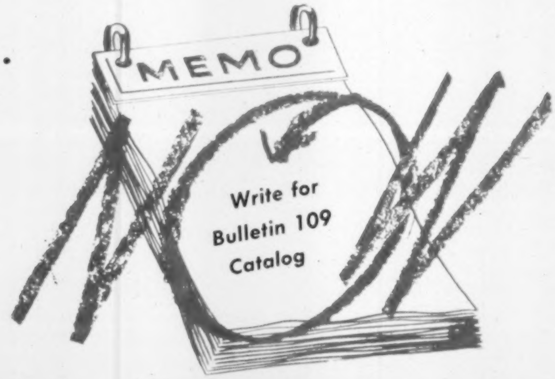


The MASSACHUSSETTS Line of Utility Type Ventilating Sets offers a wide selection of sizes, belt or direct driven, adaptable to standard size extremely heavy gauge aluminum shutters, with or without motor and drive covers, any rotation or discharge, simplified installation, suitable exterior finishes for extreme conditions, sturdy construction, complete ratings and dimension charts.



OTHER MASSACHUSETTS LINE PRODUCTS . .

- **Power Roof Ventilators**
- **Heavy Duty Blowers (Forward Curve or Backward Curve Blades)**
- **Furnace Fans**
- **Unit Heaters**
- **Propeller Fans**
- **Universal Blowers**
- **Air Conditioning Units**



Write for Bulletin 109 Catalog

MASSACHUSETTS BLOWER DIVISION

The BISHOP & BABCOCK *Mfg. Co.*

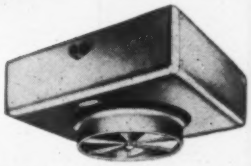
4901 HAMILTON AVENUE · CLEVELAND 14, OHIO

National Biscuit Company
Chicago, Illinois

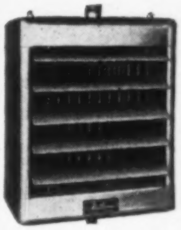
Architect: Alexander D. Crossett, New York, N. Y.
General Contractor: Ragnar Benson, Inc., Chicago, Ill.
Heating Contractor: Robert Gordon, Inc., Chicago, Ill.

NABISCO
NATIONAL BISCUIT COMPANY

Airtherm



90 VERTICAL DISCHARGE HEATERS INSTALLED from 102,500 BTU to 185,000 BTU



92 HORIZONTAL DISCHARGE HEATERS INSTALLED from 14,800 BTU to 250,000 BTU

STEAM UNIT HEATERS

WARM THE WORLD'S LARGEST BAKERY

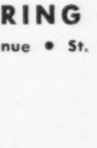
To achieve flexible, economical heating throughout Nabisco's new $20 million Chicago plant, 182 Airtherm steam unit heaters have been installed. The plant is the world's largest cracker and biscuit bakery with ovens the length of football fields, almost 20 acres of floor space and a capacity of 167 million pounds yearly.

When the area to be heated presents unusual problems, chances are you can solve them easily and economically with the flexibility of Airtherm unit heaters.

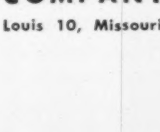
Convectors

Vertical Steam Unit Heaters

Horizontal Steam Unit Heaters



Centrifugal Fan Type Unit Heaters



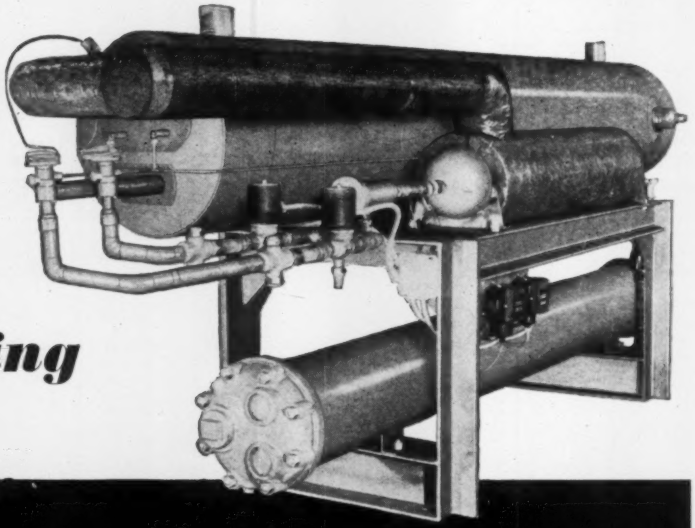
Direct Fired Space Heaters

Gas Fired Unit Heaters

FOR HEATING SATISFACTION . . . THINK FIRST OF

Airtherm

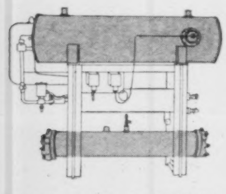
MANUFACTURING COMPANY
700 South Spring Avenue • St. Louis 10, Missouri



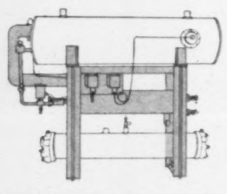
flexible air conditioning

IN A PACKAGE!

Acme FLOW-THERM® PACKAGED LIQUID CHILLER

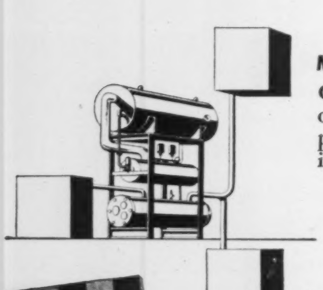


CHILLER AND CONDENSER are selected by Acme-simplified procedures to fit exact job requirements.



REFRIGERANT CONTROLS — and welded steel framework, complete the Acme Engineered Package.

For air conditioning systems or industrial processing applications in the range of 15 through 220 tons, here's the ideal "package." It's complete — less compressor — with all controls, piping and wiring factory installed and tested, ready for simple compressor connections. A truly flexible package, because the major components — famous Acme Dry-Ex Chiller with through tube construction, Shell-and-Tube Condenser(s) and Heat Exchanger are custom-selected for the exact capacity needed. Engineering time on a job is reduced appreciably, cost estimating is more accurate and installation is simple, fast and economical. Investigate Acme's Flow-Therm — both you and your client will benefit significantly. Units are ideal for Heat Pump applications.



MOUNT YOUR COMPRESSOR ANYWHERE — SAVE FLOOR SPACE AND HEAD ROOM

Compressor of any make or model can be mounted either above, below or to one side of the Flow-Therm. The inherent compactness of the Acme components, together with their compact arrangement and close-connected piping, makes for space-saving size in all Flow-Therm units.

Write today for Acme's new catalog on the Flow-Therm Packaged Liquid Chiller.

ACME INDUSTRIES, INC.

JACKSON, MICHIGAN

Manufacturers of Quality Air Conditioning and Refrigeration Equipment since 1919

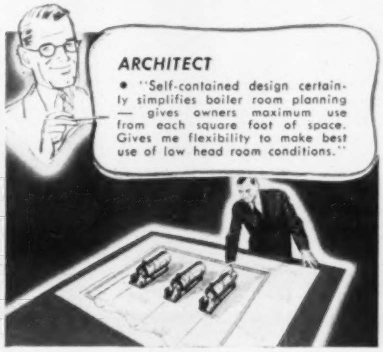
- Evaporative Condensers
- Cooling Towers — 2 to 70 tons
- Blo-Cold Unit Coolers
- Dry-Ex (direct expansion) Liquid Chillers
- Shell-and-Tube, Shell-and-Coil Condensers
- Flow-Cold packaged Liquid Chillers to 15 tons
- Flow-Therm packaged Liquid Chillers to 220 tons
- Heat Exchangers
- Liquid Receivers
- Flow-Temp Heat Pumps
- Remote Room Conditioners
- Oil Separators

CLEAVER-BROOKS SELF-CONTAINED BOILERS HAVE THE FEATURES EVERYONE WANTS!

...which feature would be most important to you?

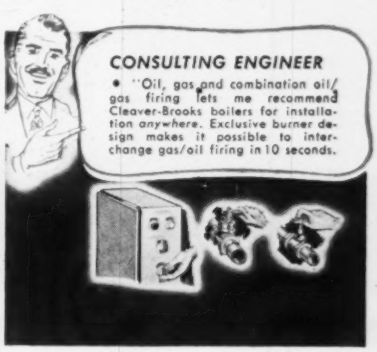
PLANT OWNER

- "Cleaver-Brooks boilers are tops in fuel economy! Forced-draft, four-pass construction and 5 sq. ft. of heating surface per boiler H.P. assure me 80% operating efficiency when firing with oil."



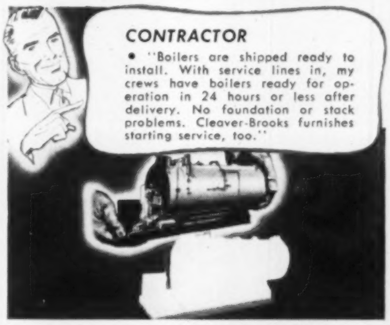
ARCHITECT

- "Self-contained design certainly simplifies boiler room planning — gives owners maximum use from each square foot of space. Gives me flexibility to make best use of low head room conditions."



CONSULTING ENGINEER

- "Oil, gas and combination oil/gas firing lets me recommend Cleaver-Brooks boilers for installation *anywhere*. Exclusive burner design makes it possible to interchange gas/oil firing in 10 seconds.

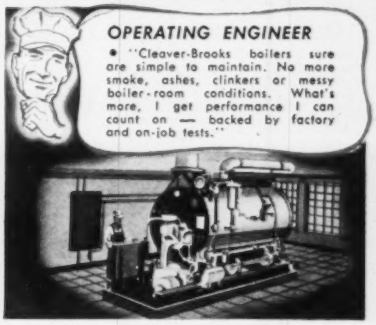


CONTRACTOR

- "Boilers are shipped ready to install. With service lines in, my crews have boilers ready for operation in 24 hours or less after delivery. No foundation or stack problems. Cleaver-Brooks furnishes starting service, too."

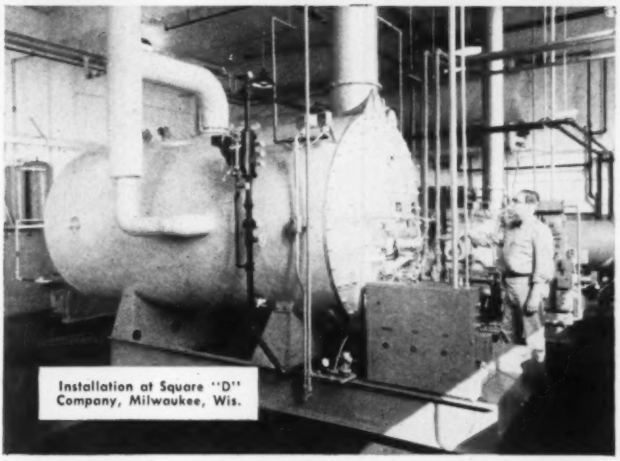
PLANT SUPERINTENDENT

- "I get all the steam I need for fluctuating steam demands, from full load down to 30% of rating. Automatic burner controls assure instant firing. I call that *real* dependability."



OPERATING ENGINEER

- "Cleaver-Brooks boilers sure are simple to maintain. No more smoke, ashes, clinkers or messy boiler-room conditions. What's more, I get performance I can count on — backed by factory and on-job tests."



Installation at Square "D" Company, Milwaukee, Wis.

THESE are just a few of the many outstanding features that have made more than 15,000 individual Cleaver-Brooks self-contained boilers *first choice* for commercial, institutional and industrial applications. Get in touch with your nearest Cleaver-Brooks representative for complete facts, or write for catalog AD-100. Cleaver-Brooks Co., Dept. H, 313 E. Keefe Ave., Milwaukee 12, Wis., U.S.A. — *Cable address: CLEBRO — Milwaukee — all codes.*

Cleaver Brooks

"It's NEW — get the facts on the CB boiler — write today!"

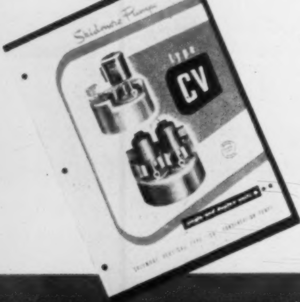
BOILERS — STEAM OR HOT WATER — FOR HEATING OR PROCESSING IN SIZES FROM 15 TO 500 HP, 15 TO 250 PSI.

For Top Performance — SKIDMORE HAS NO EQUAL!

"CV"
VERTICAL PUMP
Single unit
Duplex units are built with either the two float switches or automatic alternator.

NEW BULLETIN

Complete engineering data and capacity tables are yours for the asking . . . send for bulletin No. 21.



The Skidmore "CV" Vertical Pump can do the job — in less space and at lower cost! Its top performance has earned the respect and confidence of the critical engineer and contractor. Pump is bronze fitted throughout . . . shaft is stainless steel . . . self lubricating bronze bearing directly above impeller insures proper alignment and longer service.

CHECK THESE ADVANTAGES

- **Available in capacity range from 500 to 10,000 sq. ft. E.D.R. and discharge pressures from 10 to 40 lbs.**
- **No close tolerance or moving parts to wear — efficiency maintained.**
- **Inspected easily, without disturbing piping.**
- **Compact and rigid — requires only a space 15" x 15" x 22" for unit shown above.**
- **Receiver can be installed on floor level or in pit — has lowest possible receiver inlet opening.**
- **Cast iron receiver — for longer wear.**

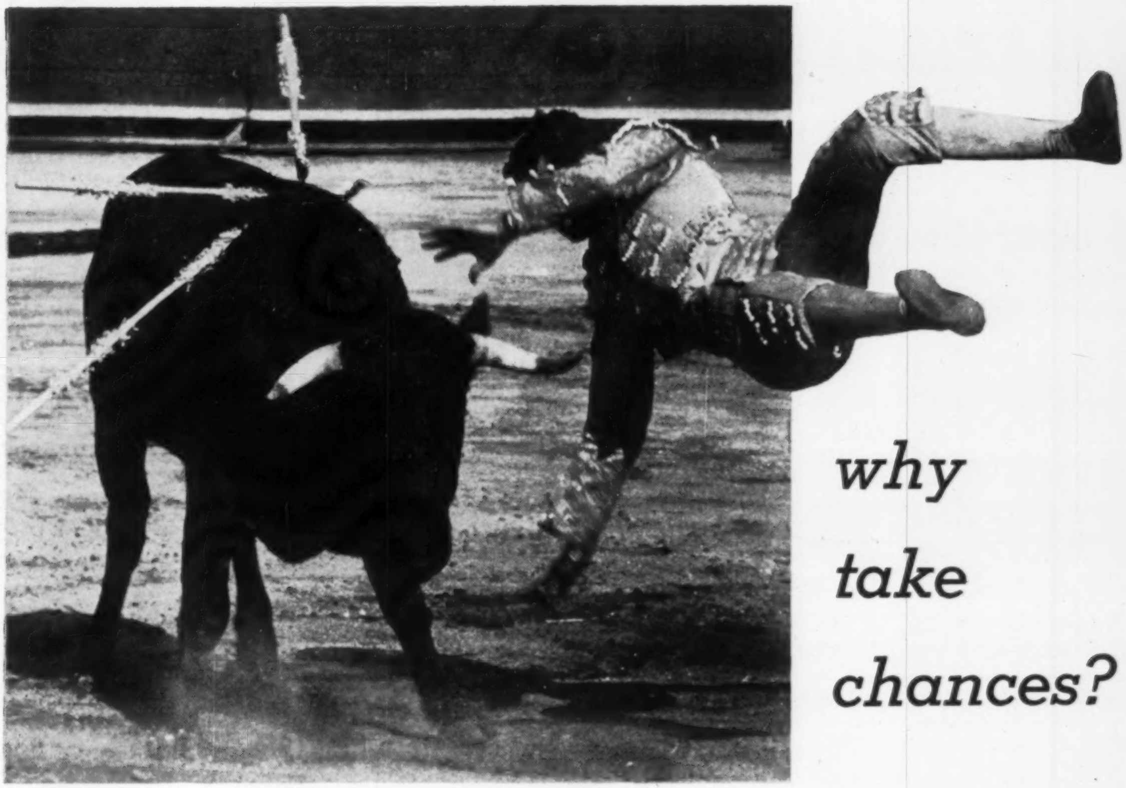
SKIDMORE CORPORATION, ST. JOSEPH, MICHIGAN

SKIDMORE
PUMPS

TYPE "UV"

TYPE "HB"

TYPE "CV" DUPLEX



why
take
chances?

UNITED PRESS PHOTO.

The Toreador is cheered for taking chances, but our business is to take the chances out of your operation. When you specify Wheatland steel pipe the "chances" have been removed through careful, precise, pressure testing, constant inspection and quality control on each length of Wheatland steel pipe. Our trade mark stands for the finest steel pipe black or galvanized that can be produced.

WHEATLAND-55

specify . .
WHEATLAND
STEEL PIPE

WHEATLAND TUBE COMPANY • Bankers Securities Building Juniper & Walnut Sts., Philadelphia 7, Penna.

NO Reducing Valve Needed

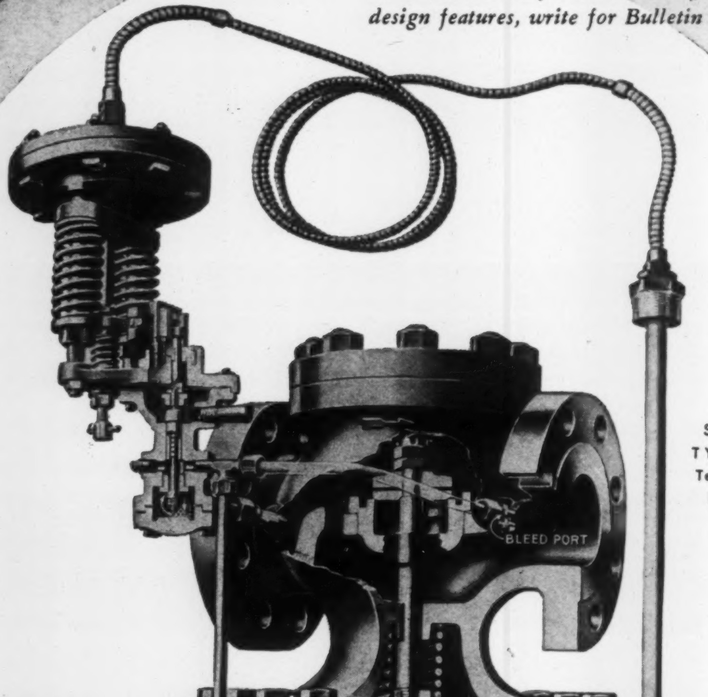
Here's real economy in temperature control.

Because Spence Temperature Regulators are designed to limit heater steam pressures to an adjustable maximum, the need for a separate reducing valve is completely eliminated.

The Spence Regulator takes steam directly from the boiler or high pressure line, reduces the pressure and regulates the flow as required to maintain a constant temperature output from the heater.

This means one relatively small combination pressure and temperature regulator replaces a reducing valve of the same size and a larger temperature regulator. Practically the entire cost of the large separate temperature regulator is saved. And, the total saving would also include the cost of a 3-valve by-pass along with all labor for installation.

This design feature is just one of the reasons for the thousands of Spence installations throughout American industry. *For details of other important design features, write for Bulletin T50.*

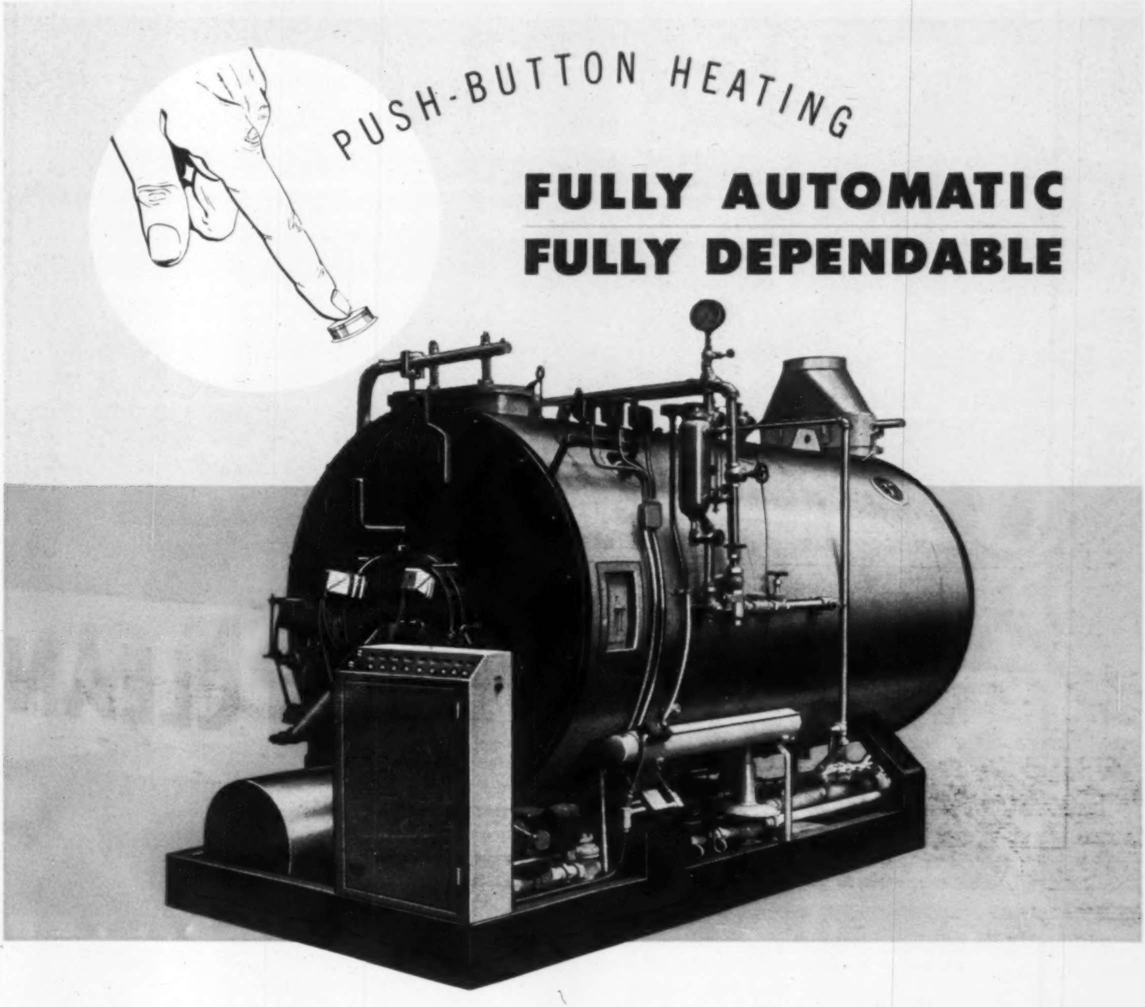


SPENCE
TYPE ET150
Temperature
Regulator

Spence

**SPENCE ENGINEERING
COMPANY, INC.
WALDEN, NEW YORK**

SE-131



FULLY AUTOMATIC
FULLY DEPENDABLE

Titusville TICOSTEAM

PACKAGE STEAM GENERATOR

Push-button controlled from a single station mounted integral with the boiler, every step in the operation of Titusville's TICOSTEAM Generator is automatic, simple, dependable and fully safeguarded. This modern, compact package steam generator is complete in every respect—finished, tested and certified at the factory, ready for your service. Operating with heavy or light oils, straight gas, or combination oil and gas, TICOSTEAM Generators are available in capacities from 2070 to 10,350 lbs. of steam per hour. Ask for descriptive Bulletin B-3100.

A Division of Struthers Wells

THE TITUSVILLE
IRON WORKS COMPANY
TITUSVILLE, PA.

Manufacturers of A Complete Line of Boilers for Every Heating and Power Requirement

SAVES 50% ON CLEAN
THE FIRST TOTALLY NEW FILTER

*This is not an idle claim . . . it's a fact . . . PROVEN UNDER ACTUAL INSTALLATION AND MAINTENANCE CONDITIONS.

Make no mistake about it . . . no matter how small your filter requirements . . . or how large, here is a completely new air filter development that can absolutely cut your clean air maintenance costs in half.

NO HEAVY TENSION OIL

Evans filters do not have a messy, sticky type of adhesive that is filthy to handle and difficult to clean. It is unnecessary and is forbidden in the use of Evans filters.

CLEAN WITH TAP WATER

Evans filters can be cleaned clean in minutes with nothing but tap water sprayed through an ordinary garden hose nozzle. They require no expensive room. No caustic cleaning solutions or agents. This eliminates all danger in the cleaning of Evans filters.

Evans Lifelong

GIVES *Lifetime* SERVICE
AIR MAINTENANCE COSTS!
DEVELOPMENT . . . IN 25 YEARS

LIGHT WEIGHT CUT LABOR COSTS

Evans filters are all aluminum. Light to handle, to carry, to pick up. In spite of airtight fitting frames, Evans filters pull quickly and easily in and out of the frames. Take much less effort, less labor to handle. No latches . . . or lugs required.

REMEMBER . . . Initial costs for air cleaning equipment are not the big factors or controlling factors in the cost for clean air.

IT'S OPERATING COSTS THAT YOU MUST LIVE WITH . . . THAT YOU MUST CONTROL. EVANS FILTERS GIVE YOU THAT CONTROL. MAKE IT POSSIBLE FOR YOU TO SAVE 50% ON CLEAN AIR MAINTENANCE COSTS.

- ALL ALUMINUM
- EVERY PART PRECISION MADE
- GIVES LIFETIME SERVICE
- HOLD UP TO 200% MORE DUST AND LINT . . . WITHOUT HARMFUL RESTRICTION TO AIRFLOW

FREE CATALOG MAIL COUPON TODAY

THE GEORGE EVANS CORPORATION - MOLINE, ILL.

Gentlemen: I wish to know how to cut my clean air maintenance costs in half with a filter that gives lifetime service. Please send me new illustrated catalog.

Name ....
Company ....
Address ....
City .... State ....

AIR FILTERS

Want control for Water Heaters or Heat Exchangers?

call POWERS

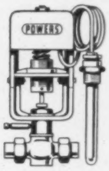
POWERS
FLOWRITE VALVE
TYPE
THE POWERS REGULATOR
TO COMPRESS SPRING TURN

FLOWRITE
One of Powers Premium Quality Diaphragm Control Valves. They're simple, sturdy and dependable.

Over 60 Years of Temperature and Humidity Control

(c28a)

You Will Insure Better Temperature Control IF—



you use the right type regulator and proper size control valve. Whether a simple self-operating regulator shown at left is required or the air operated controls featured here . . . you can get both types and others from Powers. For further information call or write our nearest office.

Powers ACCRITEM Temperature Regulator and FLOWRITE Valve—the right combination for many control problems where pressure and load conditions fluctuate widely, also for control of large size valves.

POWERS
ACCRITEM
THE POWERS REGULATOR CO

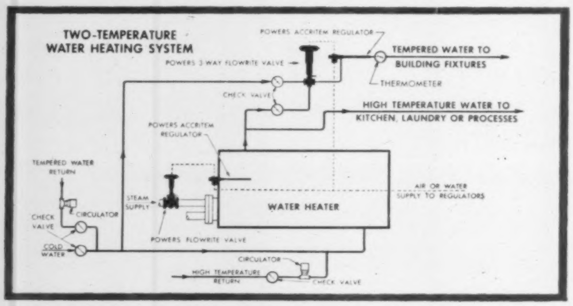
Over 50 Years Experience making this type of regulator

Control Point easily changed

Air or water operated

Ranges
50 to 250°F—150 to 350°F

VALVES: Available in a variety of body types and inner valves.

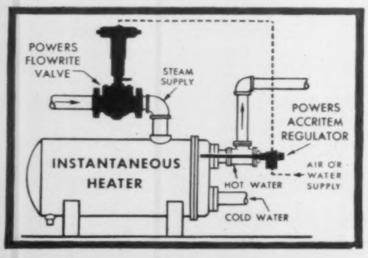

TWO-TEMPERATURE WATER HEATING SYSTEM
POWERS ACCRITEM REGULATOR
POWERS 3-WAY FLOWRITE VALVE
TEMPERED WATER TO BUILDING FIXTURES
THERMOMETER
CHECK VALVE
HIGH TEMPERATURE WATER TO KITCHEN, LAUNDRY OR PROCESSES
POWERS ACCRITEM REGULATOR
TEMPERED WATER RETURN
STEAM SUPPLY
AIR OR WATER SUPPLY TO REGULATORS
WATER HEATER
CIRCULATOR
CHECK VALVE
COLD WATER
POWERS FLOWRITE VALVE
CIRCULATOR
HIGH TEMPERATURE RETURN
CHECK VALVE

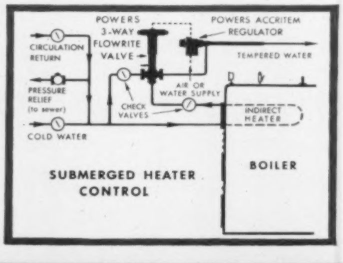
ACCRITEM TEMPERATURE REGULATOR

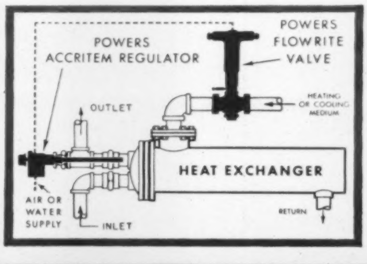
Gives Close Control and Years of Dependable Service.

- Has Adjustable Throttling Range and Calibrated Dial.
- Simple, Durable Construction assures years of trouble-free service.
- Easy to Install • Direct or Reverse Acting, reversible on the job.
- Small Size: Regulator head is 2⅞" wide, 3⅝" high, bulb is 12" long with ½" IPS Connection.

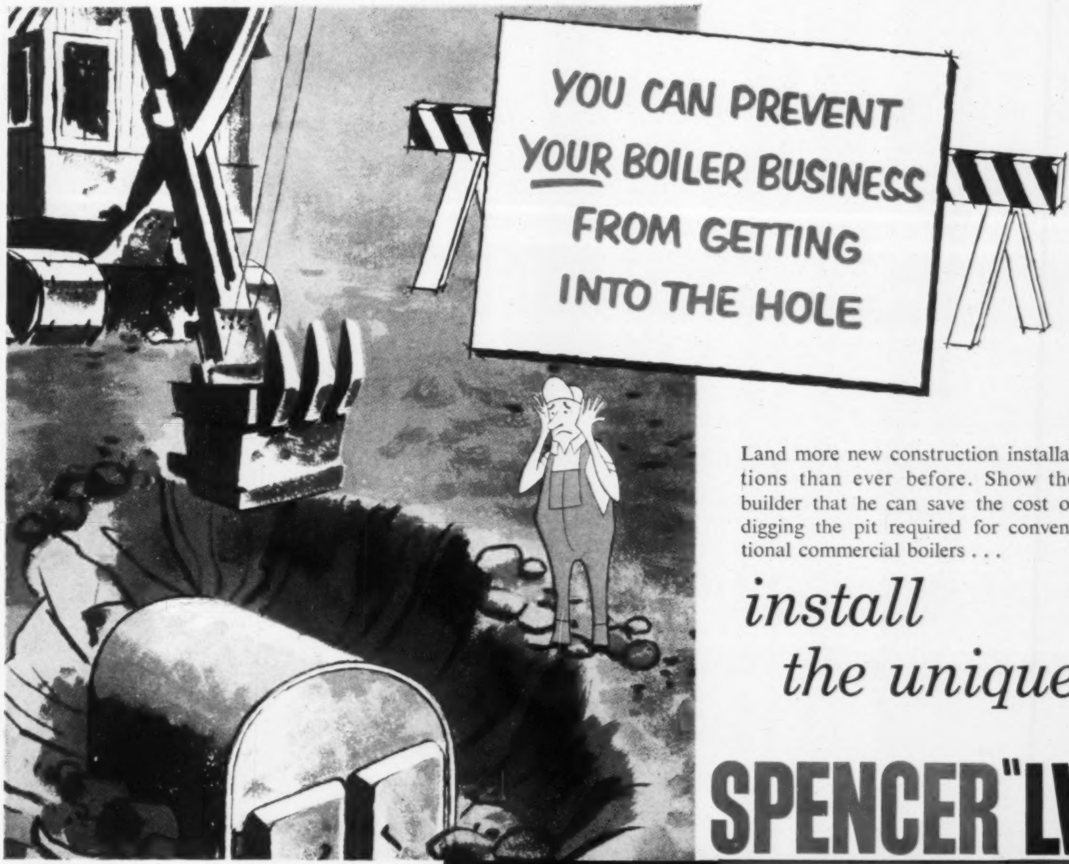
Fully Described in Bulletin 316. Write for a copy.


POWERS FLOWRITE VALVE
STEAM SUPPLY
POWERS ACCRITEM REGULATOR
INSTANTANEOUS HEATER
HOT WATER
AIR OR WATER SUPPLY
COLD WATER


POWERS 3-WAY FLOWRITE VALVE
POWERS ACCRITEM REGULATOR
CIRCULATION RETURN
TEMPERED WATER
PRESSURE RELIEF (to sewer)
AIR OR WATER SUPPLY
CHECK VALVES
INDIRECT HEATER
COLD WATER
SUBMERGED HEATER CONTROL
BOILER


POWERS ACCRITEM REGULATOR
POWERS FLOWRITE VALVE
OUTLET
HEATING OR COOLING MEDIUM
HEAT EXCHANGER
AIR OR WATER SUPPLY
INLET
RETURN

THE POWERS REGULATOR COMPANY | Skokie, Ill. • Offices in Chief Cities in U. S. A.
Also Canada and Mexico • See your phone book



Land more new construction installations than ever before. Show the builder that he can save the cost of digging the pit required for conventional commercial boilers . . .

install the unique

SPENCER "LW"

Lower waterline—over-all height of the Spencer "LW" is approximately 25% less than conventional firebox boilers. You can save excavation costs in new buildings by eliminating pit usually required.

Built in two sections—in existing buildings, divided design permits entry through narrow basement openings without tearing out walls. The two watertight sections can be moved in separately, yet require no welding.

Let Spencer build up your boiler business—write Dept. HP-75

OTHER COMMERCIAL BOILERS
IN THE SPENCER LINE

New Spencer "C." Heavy-duty commercial boiler performance at a residential boiler price! Can be fired with oil, gas or coal.

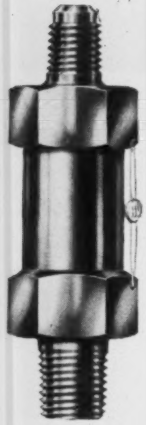
Spencer "A." Complete range of sizes from 3,500 to 50,000 sq. ft. steam, net SBI ratings. For *every* building . . . for *every* fuel.

SPENCER HEATER
LYCOMING DIVISION
WILLIAMSPORT AVCO PENNSYLVANIA

ASME and SBI Approved

HENRY
ASME
relief valves

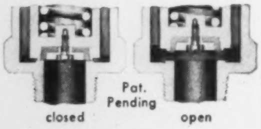
for Extra Capacity Extra Safety



Type 523 Straight-Through Relief Valves

FOR FREON AND SIMILAR REFRIGERANTS

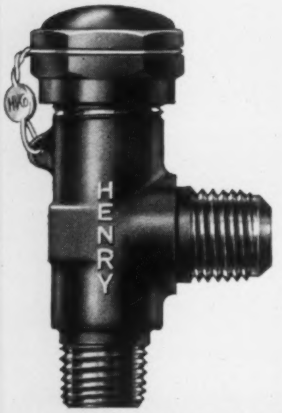
This relief valve has the Henry "Controlled Cushion" cup seat disc construction which prevents deformation of sealing ring and assures consistent operation. This design provides positive relief at predetermined set pressures. Brass construction. Sizes (inlet x outlet) ½" M.P.T. x ⅝" Flare; ½" F.P.T. x ½" F.P.T.; ¾" F.P.T. x ¾" F.P.T.; and 1" F.P.T. x 1" F.P.T.



"Controlled cushion" cup seat disc construction

Type 52 Angle Relief Valve

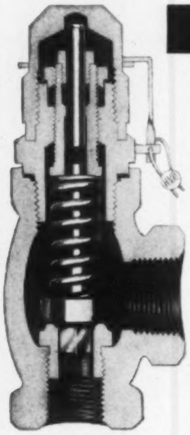
This forged brass valve is available in sizes (inlet x outlet) ½" M.P.T. x ⅝" Flare and ⅝" O.D.S. x ⅝" O.D.S.



UV ASME

NB National Board Certified

All Henry Relief Valves in the sizes and types listed below are constructed in accordance with the standards of the ASME. In addition these valves are stamped NB to indicate National Board Certification as to capacities.



FOR AMMONIA

Angle Relief Valve

Has soft metal alloy seat and push rod for emergency reseating. Stainless steel trim. Sizes (inlet x outlet) ½" F.P.T. x ¾" F.P.T.; ¾" F.P.T. x 1" F.P.T.; and 1" F.P.T. x 1¼" F.P.T.

All the above valves can be furnished at any desired pressure setting in the range of 50-350 P.S.I.

Write us for data sheet #AE-1303 showing new increased capacity ratings of these Henry relief valves.

See your Henry wholesaler for these certified relief valves.

HENRY VALVE CO.
CONTROLLING FLOW
SINCE 1914

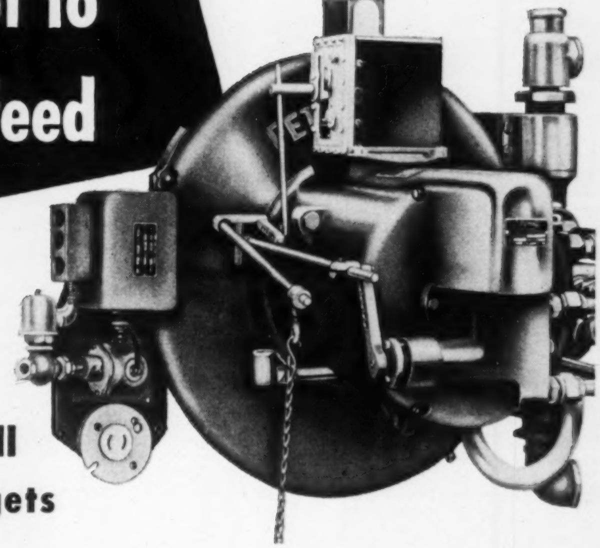
HENRY VALVE CO.

Melrose Park, Ill. (Chicago Suburb)
Cable: HEVALCO, MELROSE PARK, ILLINOIS

Specialized Manufacturers of the Complete Line of Relief Valves for Refrigeration and Air Conditioning

Sure . . . you can cut firing costs by burning heavy fuel oil . . .

but you've got to control the oil feed



and Petro does this superlatively well without complicated gadgets

The so-called viscosity problem with heavy oils is overrated. This is so because the viscosity of *all* fuel oils approaches a common point as the temperature is raised, and the temperature at which viscosity becomes a negligible factor is well within a practical operating range.

The Petro thermal viscosity control system is simply this: an electric valve controlled by the oil temperature refuses to admit oil to the atomizing cup until the oil has reached a desirable burning temperature. This temperature is arrived at by circulating the oil through heaters when necessary. This accomplishes four important results:

1. Viscosity control permits accurate metering of oil.
2. Oil is thin enough for extremely fine atomization.
3. Hot oil ignites easily.
4. Petro *never* has a slug of cold oil in the feed line to foul up a cold start.

That is why the Petro burner can fire the economical heavy oils without a fearsome array of fancy trimmings. It is fool proof, gadget free, and completely dependable—all good reasons why Petro is the largest selling industrial oil burner in America.

A reservoir of warm oil is maintained. In the use of this thermal viscosity system, all of the heated oil which is not required for immediate firing is returned to the storage tank. Thus a constant pool of warm oil is ready for any changes in firing needs. The amount of oil being returned is easily regulated by the owner of the burner, to suit his individual needs.

No manual attention is required

The entire operation is automatic. There are no involved mechanical controls requiring adjustment or maintenance.

Saves labor costs—saves fuel costs

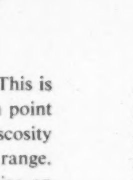
Why don't you find out how much Petro industrial oil burners can save for you? They are quickly adaptable to nearly every existing boiler. Send in the coupon below for full information.

PETRO

T.M. REG. U.S. PAT. OFF.

OVER 50 YEARS OF LEADERSHIP IN AUTOMATIC HEATING AND POWER EQUIPMENT

SEND FOR FREE LITERATURE



PETRO, 3241 West 106th Street,
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In Canada: 2231 Bloor Street West,
Toronto, Ontario.

Please send me literature and specification sheets on money-saving Petro commercial and industrial burners.

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Company ____________________

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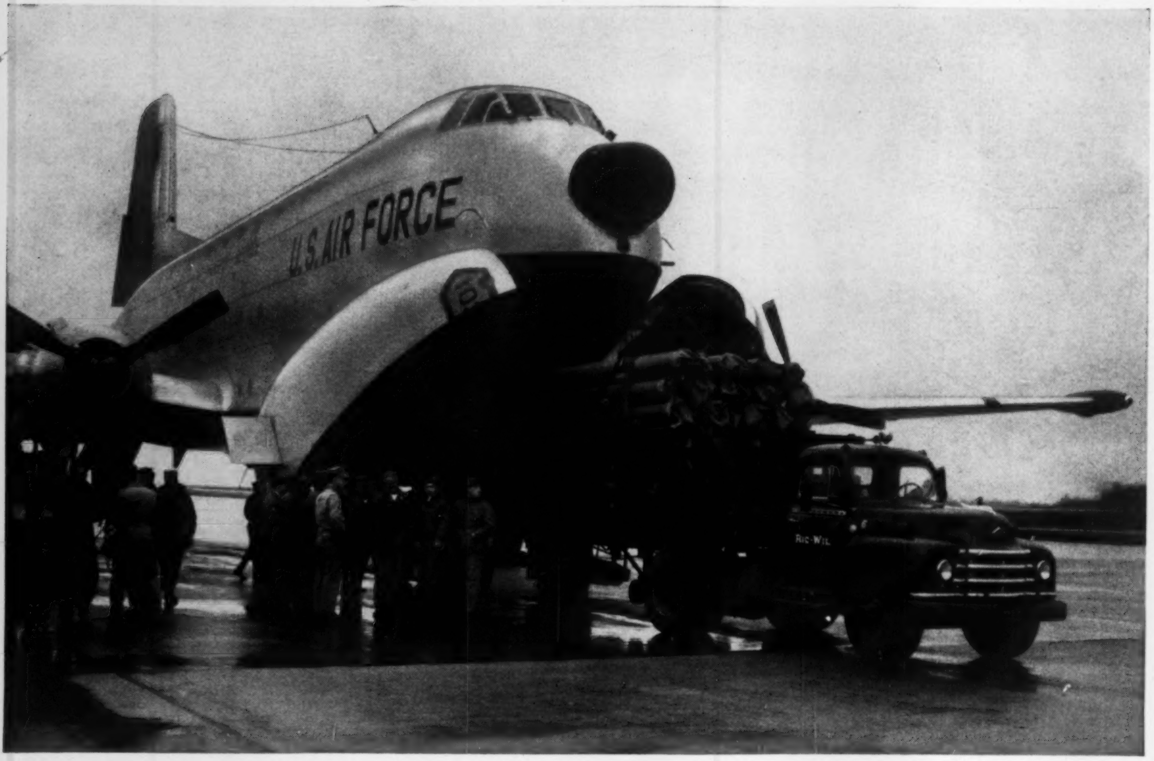
Delivery...ON TIME...



A delay on this particular job meant valuable time lost . . . dollars wasted . . . Ric-Wil, not only prides itself in offering the finest in prefabricated insulated piping, but takes pride in ON TIME DELIVERY . . . and speaking of delivery . . . the best way to meet piping construction schedules is to contact your Ric-Wil representative early in the planning stage. He will be glad to help on scheduling delivery . . . and "lend a hand" on technical information as well.

RIC-WIL
BARBERTON, OHIO

New Ric-Wil catalog is available . . . write for your copy . . . now.

Quality Piping Systems . . .
. . . of Exceptionally High Thermal Efficiency

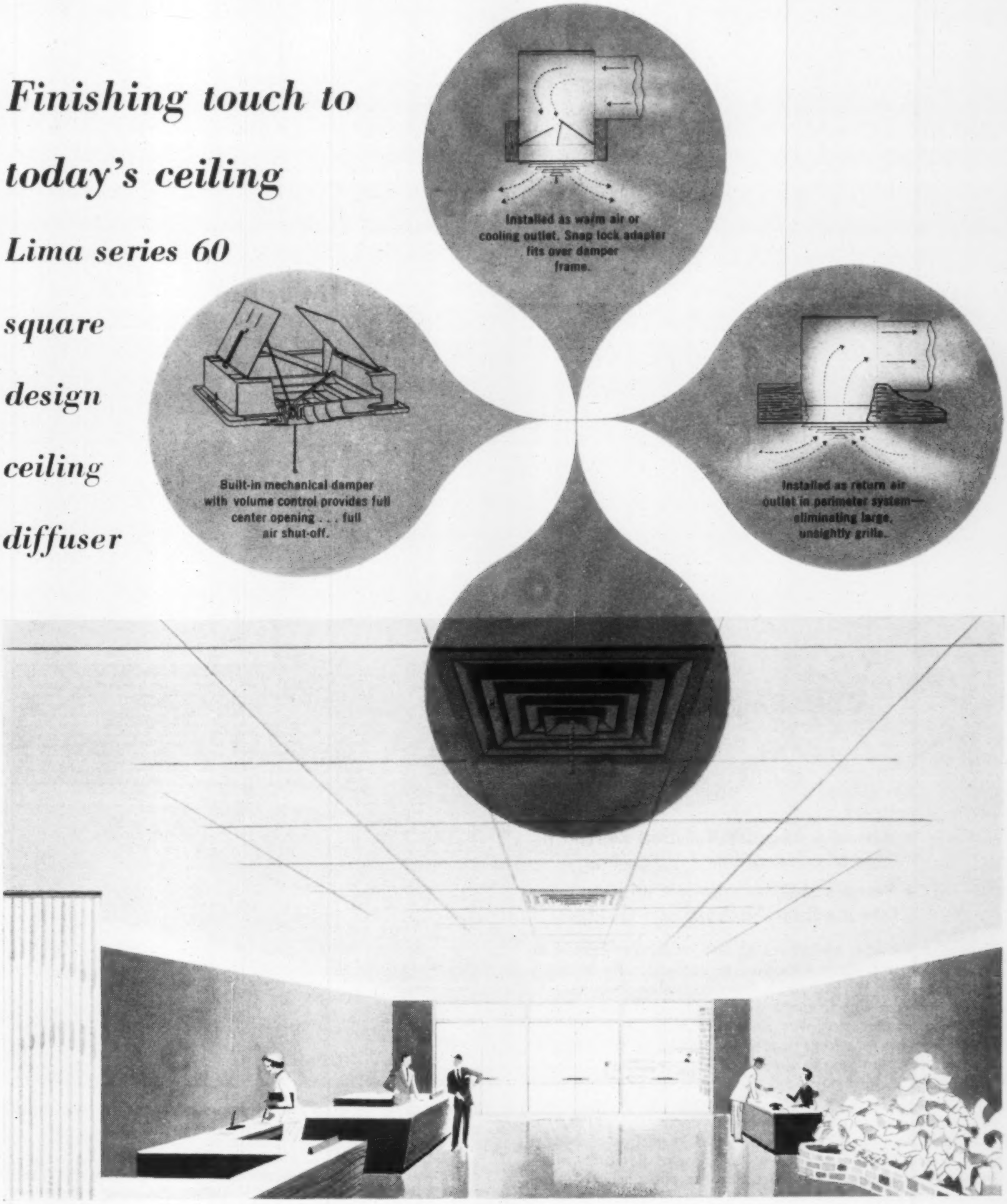
RIC-WIL INCORPORATED

PREFABRICATED INSULATED PIPING SYSTEMS

BARBERTON, OHIO

Finishing touch to today's ceiling

Lima series 60 square design ceiling diffuser


Installed as warm air or cooling outlet. Snap lock adapter fits over damper frame.
Built-in mechanical damper with volume control provides full center opening . . . full air shut-off.
Installed as return air outlet in perimeter system—eliminating large, unsightly grills.

accentuates the beautiful symmetry of modern ceilings

When the specs call for a ceiling diffuser, you'll make your customer happier—and your job easier—by installing the Lima square design ceiling diffuser. It harmonizes beautifully with today's acoustical tile or block ceilings, and modern rectangular rooms. Light beige Lima finish is permanent and requires no repainting.

assures complete comfort in heating and cooling

The Lima-engineered square design and tiers of step-down vanes provide greater free area for more effective air diffusion in all directions at correct angles for complete indoor comfort—in heating and cooling. *Ask your jobber's salesman or write direct for new complete Lima catalog.*

Lima REGISTER COMPANY
LIMA, OHIO

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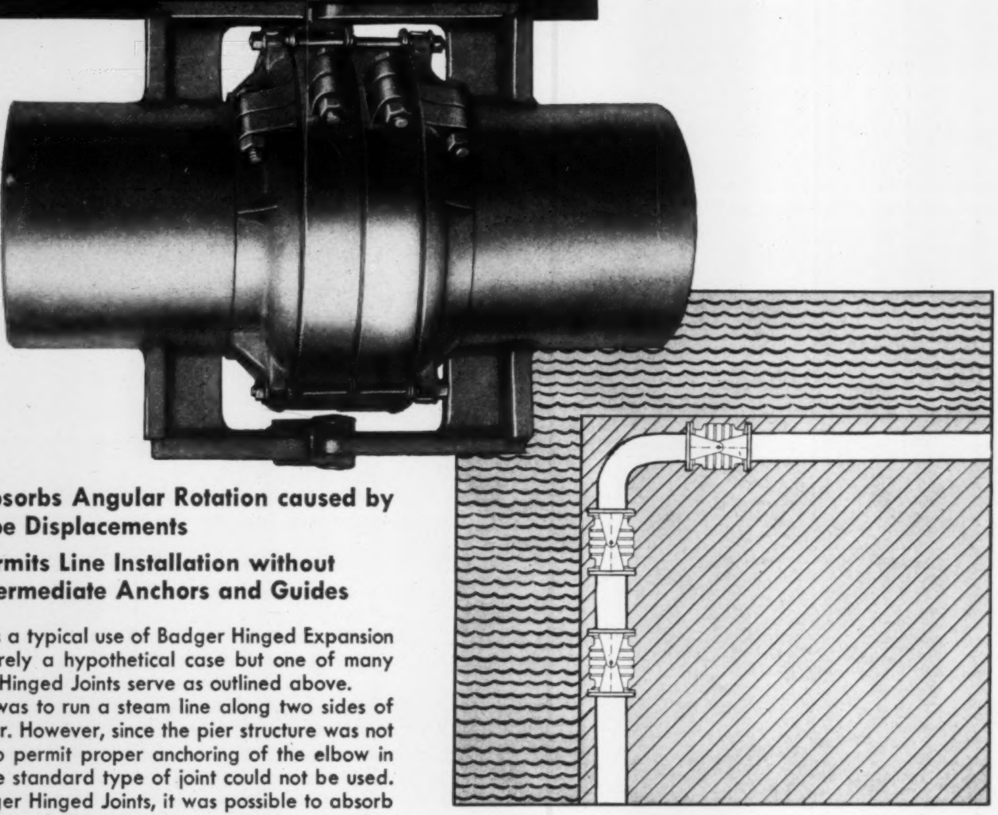
Typifying Expansion Joint Engineering
At its Best

THE *Hinged* EXPANSION JOINT



- **Absorbs Angular Rotation caused by Pipe Displacements**
- **Permits Line Installation without Intermediate Anchors and Guides**

The sketch shows a typical use of Badger Hinged Expansion Joints . . . not merely a hypothetical case but one of many instances where Hinged Joints serve as outlined above.

The problem was to run a steam line along two sides of a waterfront pier. However, since the pier structure was not strong enough to permit proper anchoring of the elbow in the pipe line, the standard type of joint could not be used. With these Badger Hinged Joints, it was possible to absorb the large amounts of thermal expansion in the pipe line without the need for an intermediate anchor.

Hinged Joints must always be used in groups of two or more. Three such joints give a maximum of flexibility while reducing to a minimum the thrust on the end anchors.

The Hinged Joint is but one of several special Badger Expansion Joints designed for unusual conditions. Why not outline *your* proposed pipe line installations to our engineering department? We can serve you whether special or conventional type expansion joints are needed. And back of our service is some sixty years of experience.

Badger Expansion Joints come in a variety of types and a wide range of sizes: Directed Flexing, Self-Equalizing for longer traverses and higher pressure; Non-Equalizing, for shorter traverse and when pressures are low; Tandem Joints for combination axial and lateral movements; Clevis or Hinged Joints for angular rotation.

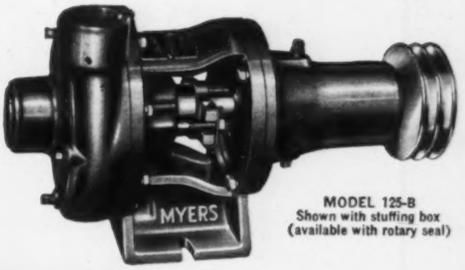
Corrugated Flexible Connectors; Flexible Pipe Line Seals for watertight connection between pipe and flood walls.

BADGER MANUFACTURING COMPANY

Original and Sole Manufacturer of Badger Expansion Joints

230 BENT STREET • CAMBRIDGE 41, MASS.

MODEL 125-M
Shown with stuffing box
(available with rotary seal)


MODEL 125-B
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NOW...a complete line
of centrifugal pumps
for air conditioning from...
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MODEL 100-B
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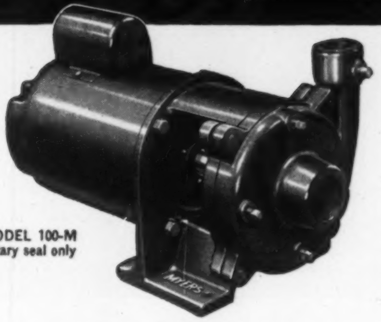
MODEL 100-M
Rotary seal only

FULL RANGE OF SIZES
⅓, ½, ¾, 1, 2, and 3 horsepower, motor-mounted or belt-driven models.

TWO CASING SIZES
1″ x 1¼″ or 1¼ x 1½″.

ALL-BRONZE IMPELLER
Accurately balanced for smooth operation.

REMOVABLE BRONZE WEARING RINGS
Easily replaced for longer pump life.

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Eliminates leakage (stuffing box may be specified on "125" models.)

CORROSION-RESISTANT SHAFT
Stainless steel for trouble-free service.

WIDE RANGE OF CAPACITIES AND HEADS
Capacities to 90 GPM. Heads up to 135 feet.

Write today *for Bulletin 210 on* Myers *Centri-Thrift Pumps.*

Myers PUMPS WATER SYSTEMS AND WATER SOFTENERS

The F. E. Myers & Bro. Co., Dept. HP-7, Ashland, Ohio

SIL-FOS BRAZE

non-ferrous piping to make sure of

LOWEST END COST

Here's why a non-ferrous piping installation made with the low-temperature silver brazing alloy, SIL-FOS, is bound to be lowest in end cost:

1. SIL-FOS brazing permits the use of light-weight tubing – which means a tremendous saving in weight and metal over corresponding sizes of pipe needed for threaded assembly.
2. SIL-FOS brazing is so much faster it saves days and weeks on installation time and labor, depending on the size of the job.
3. The SIL-FOS brazed installation is virtually maintenance-free. That's because SIL-FOS joints are permanently leak-proof and have the ductility to withstand the stresses and strains imposed by buildings settling, by vibration, by wide temperature changes, etc.

These are the basic reasons why the water lines – hot and cold – in the New York City low-cost housing projects at Throgg's Neck (below) and Edenwald, totaling some 4,000 apartments in 70 buildings – are all SIL-FOS brazed.

As the plumbing contractor put it – *"For protection of the investment and to insure a permanent, low-maintenance installation we elected to silver braze with SIL-FOS."*

THROGG'S NECK
New York City Housing Authority
Project in the Bronx, N. Y.
ASSOCIATED ARCHITECTS
Francis Keally and Howard S. Patterson
GENERAL CONTRACTOR
D. M. W. Contracting Co., Inc., Brooklyn

GET THE FULL FACTS ABOUT SIL-FOS BRAZING

BRAZING NEWS No. 61 tells about the installations in the New York housing projects and others . . . *BULLETIN 17* gives complete step-by-step instructions for brazing pipe and tubing with SIL-FOS . . . *BULLETIN 20* gives details about the alloy and the reasons for the great strength, speed and economy of SIL-FOS brazing. Write for your copies today.

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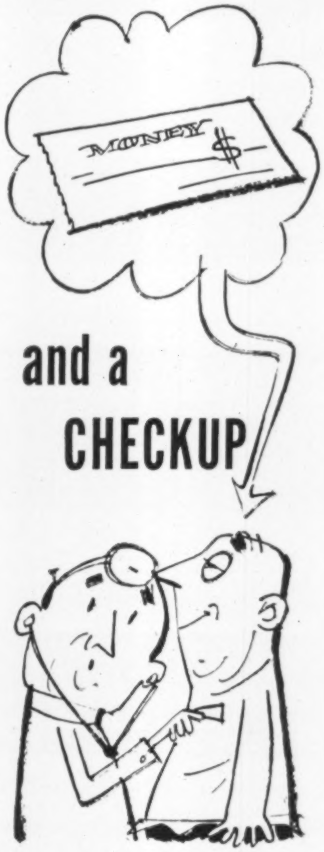
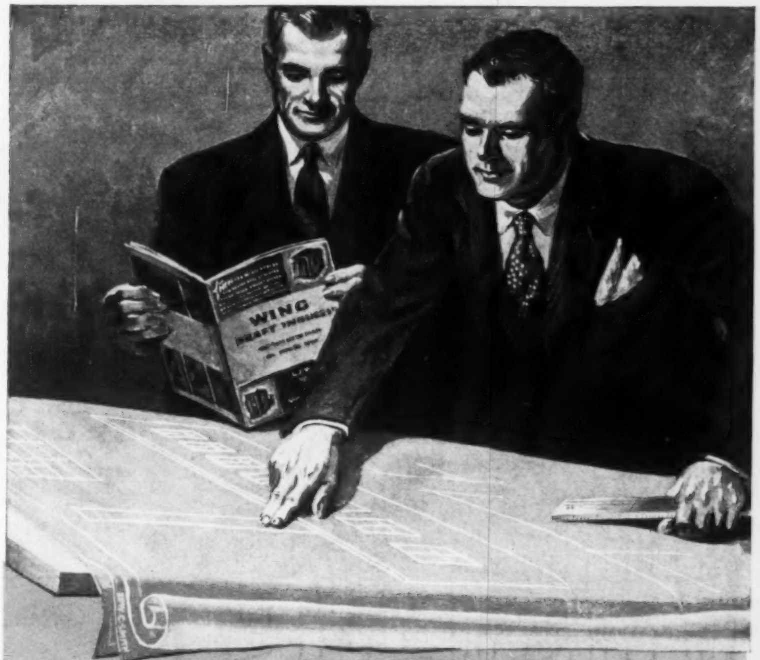
fight cancer
with a CHECK



and a
CHECKUP

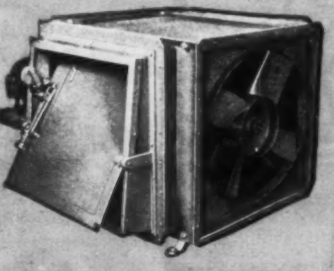
a check
to help others...
a checkup
to help yourself.

AMERICAN
CANCER SOCIETY



"...Let's cut this stack off here and put a Wing Draft Inducer on the boiler... We'll save the cost of the chimney, have better draft and a better looking building."

If you are building or rebuilding or increasing the size of your boiler plant, a costly, tall chimney can add considerably to the expense. And a well planned architectural design can be ruined with an unsightly, towering stack.



WING DRAFT INDUCERS eliminate this problem, providing positive, adequate, uniform draft regardless of surrounding conditions, or variable weather. They cut operating costs too, by giving higher CO_2's. Smoking is reduced or eliminated. Higher boiler capacity is possible. *Write for Bulletin I-55. Use the coupon.*

L. J. Wing Mfg. Co. **140 Vreeland Mills Road, Linden, New Jersey**
Factories: Linden, N.J. & Montreal, Can.

L. J. Wing Mfg. Co., Linden, New Jersey HP-7
Please send me Bulletin -55—Draft Inducers
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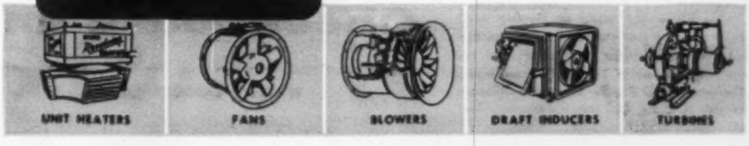
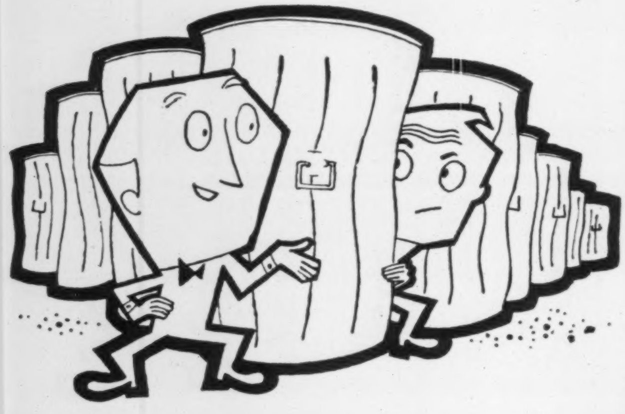
Wing





What is in all the ash cans?

Ashes, of course.

Isn't that a lot of ashes for a small plant?

Certainly it is, but somebody found a "bargain" coal. It cost less per million BTU's and he never stopped to figure it contained four times as much ash.

It costs money to clean and haul out ashes, doesn't it?

That's not all. Think what we are paying in freight to haul tons of useless ashes from the mine. And all those ashes in the fuelbed cut down boiler efficiency. We don't have the additional steam capacity we had with the better coal.

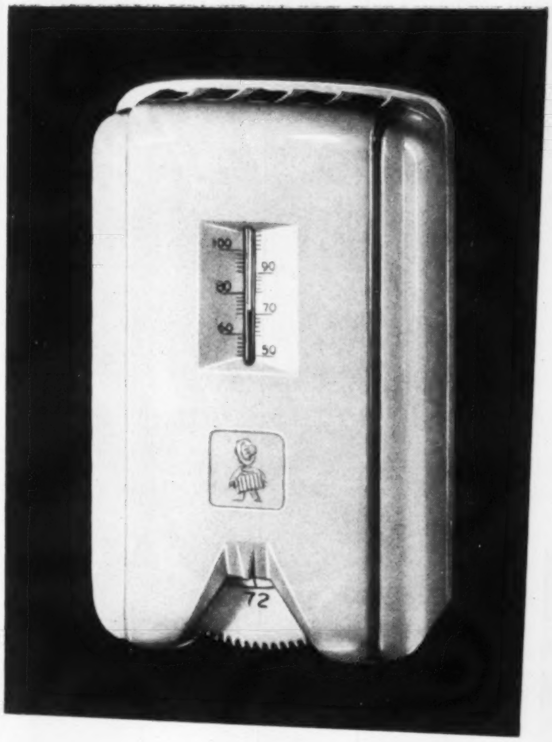
Intelligent selection of the most economical coal requires careful consideration. It isn't just a matter of price. You should figure the job to be done and the equipment you have to do it. The superior quality coal produced at mines served by the Chesapeake and Ohio will meet our most exacting requirements. Before we sign another coal contract, let's get a C&O coal man in here to give us the facts and figures on which coal will cost us least in the long run.

P.S.

There's a lot more to buying coal than the cost per ton. For facts and figures to solve your particular fuel requirements, write to: R. C. Riedinger, General Coal Traffic Manager, Chesapeake & Ohio Railway Company, Terminal Tower, Cleveland 1, Ohio.

Chesapeake and Ohio Railway

WORLD'S LARGEST CARRIER OF BITUMINOUS COAL



This new Fulton Sylphon Room Thermostat, No. 801 Series, operates within plus or minus ½° of set point. The compact, sturdy design employs a powerful Sylphon Bellows thermostatic unit to provide accurate response to the slightest change in room temperature.

Cable or blanket type panels, wall heaters, suspended unit heaters and portable heaters are accurately controlled by this heavy duty, line voltage type unit. The No. 801 Thermostat can be used also for direct line voltage control of stokers, oil burners and circulating pumps. Use the convenient coupon for complete details.

NEW
ROOM THERMOSTAT

• For Electric Heating Units • Small As A Switch Plate And Extends Out Only 1⅞" • Rating: 20 amps. (non-inductive load) at 125-250 V.A.C.; ¾ HP at 115 V.A.C. and 1½ HP at 230 V.A.C. • Easily Installed • UL Approved

FROM
FULTON SYLPHON
TEMPERATURE
REGULATOR
HEADQUARTERS,
U.S.A.

FULTON SYLPHON DIVISION
Knoxville 1, Tennessee

Please send me a copy of the new Room Thermostat Bulletin 801.

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Robertshaw-Fulton
CONTROLS COMPANY
FULTON SYLPHON DIVISION

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ASK for the BRAND that assures TOP QUALITY!
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READING COPPER TUBE

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It's logical to expect superior quality when you ask for *Reading* Copper Tube—you're asking for tubing made by the *"specialists"* of the industry! By making tubing, and only tubing, in one of America's largest, most modern, completely integrated mills, Reading's production experts are able to direct *all* their know-how toward the creation of a better product.

Even Reading's "shirt sleeve" service sets a new standard of quality. Everyone, from our "top brass" on down, stands ready to help you do a better job and build a better business.

Ask for QUALITY next time you order copper tubing ...ask for READING!

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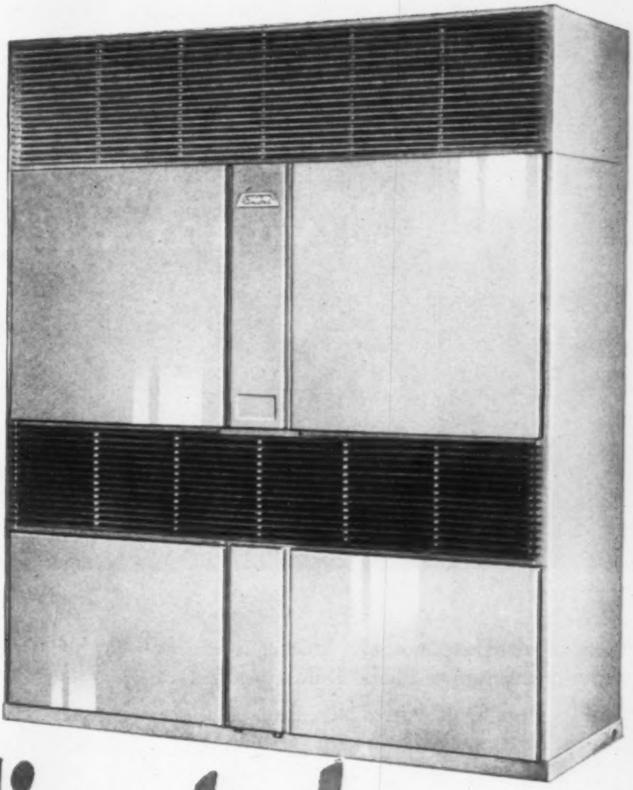
Exterior view of the Mueller Climatrol Type 904-10 and 15-hp air conditioner. Note the smart styling, concealed control panel.

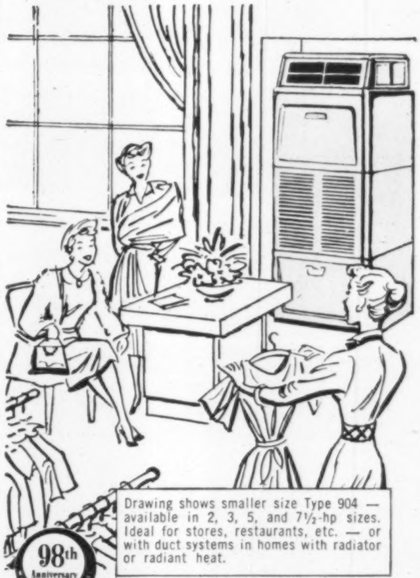


NEW!

FOR THE BIG COOLING JOBS

Mueller Climatrol

adds 2 new sizes . . . 10- and 15-hp . . . to its Packaged Air-Conditioner Line



Drawing shows smaller size Type 904 — available in 2, 3, 5, and 7½-hp sizes. Ideal for stores, restaurants, etc. — or with duct systems in homes with radiator or radiant heat.

WITH the addition of these two new sizes to the Type 904 line of packaged air conditioners, Mueller Climatrol now gives you a full line to work with — from 2- to 15-hp. These new units are jam-packed with features — take a look.

Type 904-10 — the new 10-hp unit. Smartly styled with a convenient, concealed control panel in front, it stands 98$\frac{9}{16}$" high, 82¼" wide, 31⅛" deep. Uses two 5-hp Worthington compressors, has two shell-and-coil-type condensers and two centrifugal blowers. The refrigerant is Freon 22.

Type 904-15 — gives you 15-hp of cooling. It comes in the same casing as the Type 904-10 and requires the same floor space. However, it uses two 7½ hp compressors, and correspondingly larger twin coils, blowers, condensers. Other features are the same.

Both can be used for year 'round air conditioning — provision has been made for adding either a steam or hot-water coil so that these new units can provide space heating in winter, as well as cooling in summer.

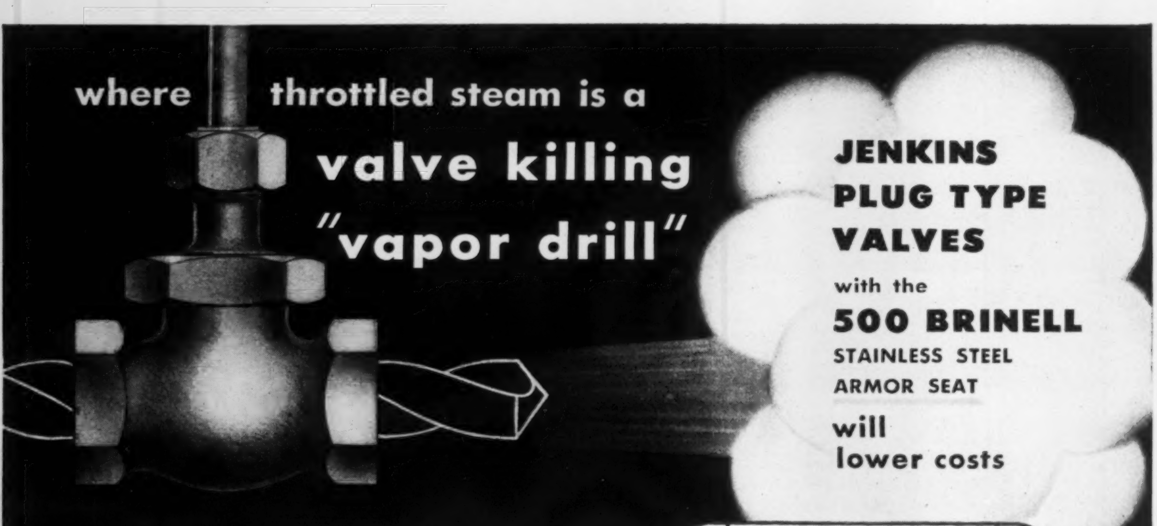
Easy to install — the Type 904-10 and 15 are self-contained and come from the factory completely charged and prewired for easy installation.

There's money in the big cooling jobs — so go after it with Mueller Climatrol to make more sales and to add to your reputation as a *comfort expert*. Write for complete data on these units. Mueller Climatrol, Dept. 275, 2023 W. Oklahoma Ave., Milwaukee 15, Wisconsin.

D-188

98th Anniversary

NEARLY 100 YEARS OF MANUFACTURING QUALITY COMFORT EQUIPMENT



where throttled steam is a valve killing "vapor drill"

JENKINS PLUG TYPE VALVES
with the
500 BRINELL
STAINLESS STEEL ARMOR SEAT
will lower costs

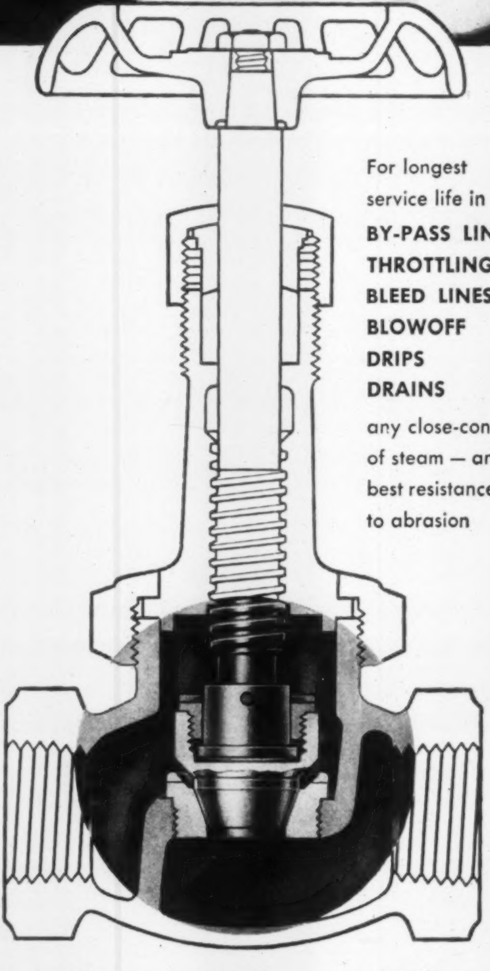
Closely regulated steam erodes grooves in seating units and drastically cuts service life of ordinary valves.

Jenkins Plug Type Valves have been engineered in every detail for maximum wear in such valve-killing service. The stainless steel Armor Seat defies the "vapor drill", and Jenkins quality throughout gives them top rating for wear-proof and trouble-proof perfomance.

Make you own test . . . in your toughest steam service . . . or anywhere that abrasion or erosion causes frequent valve failure. Compare, part for part, with any similar valve. You'll find that, again, Jenkins *extra value* pays off in longer life and lower maintenance cost.

Plug and seat ring are Jenkins JX500, a Stainless chromium alloy steel made to Jenkins high strength specifications, heat-treated to 500 Brinell. Seating surfaces are super-hard and mirror-smooth, offer highest resistance to galling, cutting, abrasion, and erosion. Wide, steep, 30° total taper permits extremely close regulation of flow and vapor-tight closure.

The Stainless steel plug is securely fastened to the spindle with a bronze locknut. Spindle is aluminum bronze with a tensile strength exceeding 70,000 lbs., — has high corrosion resistance.



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BY-PASS LINES
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any close-control of steam — and for best resistance to abrasion

300 lb. 200 lb. 150 lb.
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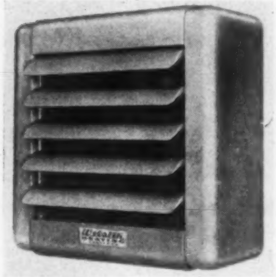
EQUIPMENT DEVELOPMENTS . . .

For reviews of Recent Trade Literature see Page 238



Propeller Fan Heaters . . .

. . . with continuous "U" bend universal coil for either hot water, steam —Warren Webster & Co., 1664 Federal St., Camden 5, N.J. Cited features: back piping connections for closer installation to ceiling, choice of horizontal or double deflection type louvers, quiet operation handling large air volumes. In 24 unit range with 63 to 1395 sq ft EDR basic steam ratings.

SQUARE D COMPANY

Pump Control Switch . . .

. . . designed for applications needing protection on loss of pressure or to initiate cycle of operation on rising pressure—Square D Co., 4041 N. Richards St., Milwaukee 12. For pressures to 80 psi. In single, double pole types.

Room Air Conditioners . . .

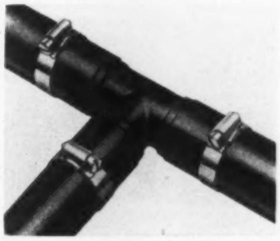
. . . for year 'round air conditioning of multiroom buildings—Trane Co., LaCrosse, Wis. Measures 9 in. deep. Features new water coil design. In vertical cabinet, vertical concealed, horizontal ceiling mounted, horizontal concealed models. Units convert from concealed to cabinet types, vice versa.

Framing Channels . . .

. . . with lightweight metal construction for mechanical and electrical supports, shelving, racks, display framing—Unistrut Products Co., 1013 W. Washington Blvd., Chicago 7. New "A" line for uses where weight, strength of company's "S" line not required. Requires only hacksaw, wrench to erect. In three sizes of 10, 20 ft lengths.

Hydraulic Bender . . .

. . . for pipe features lightweight design—Greenlee Tool Co., Rockford, Ill. Consists of two speed hydraulic pump, bending ram. Quickly disconnected by speed coupling for easy handling, says company. Bends ½ to 2 in. rigid conduit and pipe 90 deg. Also ram fits other of company's bending attachments.

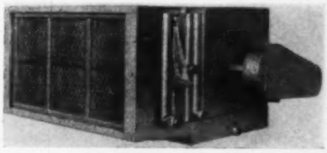


Clamps . . .

. . . for making connections on flexible plastic pipe—Wittek Mfg. Co., 4305 W. 24th Pl., Chicago 23. Stainless steel construction. Is one piece housing attached to clamp band. Housing supports worm drive screw.

Air Meter . . .

. . . for direct measurement of air temperature, velocity, static pressure —Anemostat Corp. of America, 10 E. 39th St., New York. Measures velocities to 8000 fpm, temperatures zero to 255 F, static pressures to 8 in. water gage. Portable design. Powered by standard flashlight batteries. May be used in ducts, free spaces, at air inlets and outlets.

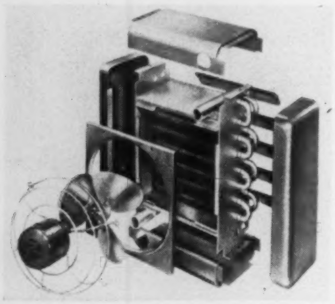


Air Conditioning . . .

. . . units for industrial, commercial applications—American Blower Corp., Detroit 32. Central station, cabinet type design. Cited features: compactness, simple installation, design flexibility, wide capacty range in all types from 600 to 48,000 cfm. Three basis units included in company's new line: air conditioning units, sprayed coil conditioner units, multizone conditioner units.

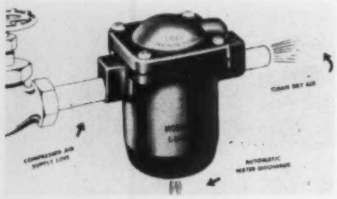
Absorption Machines . . .

. . . with no major moving parts, designed to produce chilled water from steam—Carrier Corp., Syracuse. In 11 sizes with capacities 100 to 700 tons. Will adjust from full down to almost zero load with little efficiency loss, says company. Operates on gas, low pressure steam.



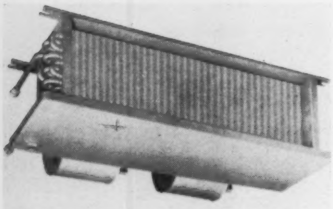
Unit Heater . . .

. . . with propeller fan design, universal continuous "U" bend coil—John J. Nesbitt, Inc., State Rd. and Rhawn St., Philadelphia 36. Construction of heating coil designed to permit high water capacities with low water rates, high temperature drops. Condensing coils partially staggered on two-row coils to provide maximum heat with minimum air flow resistance, says company. In 24 models with capacities 15,000 to 335,000 Btu per hr.



Pipe Line Filter . . .

. . .for compressed air—Engman Mfg. Co., EMCO Pneumatic Div., 1317 Locust St., Des Moines. Designed for prevention against water, grit, scale, sludge. Operates at pressures to 200 psi. For 1/4 in. pipe.

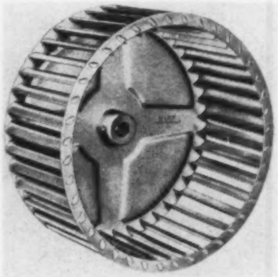


Room Air Conditioner . . .

. . .for existing hotels, motels, hospitals, offices—A. H. Witt Co., 940 N. Sycamor, Los Angeles. Designed for quiet operation. Requires only connecting of pipes from unit to cooling or hot water system. Units controlled individually. In 14 sizes 300 to 1200 cfm. Also larger models for use in duct systems.

Motors . . .

. . .with totally enclosed, explosion-proof design—U.S. Electrical Motors, Inc., Box 2058, Los Angeles 54. Designed for operation where dangerous fumes, dusts, combustible materials, moisture prevalent. With ratings 1 to 10 hp. In fanless types 1 to 1½ hp.



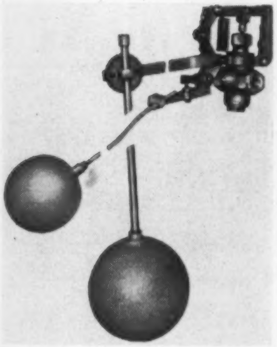
Blower Wheels . . .

. . .with forward curved blades for room air conditioners, dryers, furnaces, oil burners—Revcor Co., P. O. Box 25, Carpentersville, Ill. In steel or aluminum, with 18 diameters 2 9/16 to 12⅜ in., single and double inlet types. Designed for where space dimensions require greater performance from smaller wheels.

No 37
AutoVent
RELIEF VALVE
PAT No 2100512
MAID-O-MIST INC

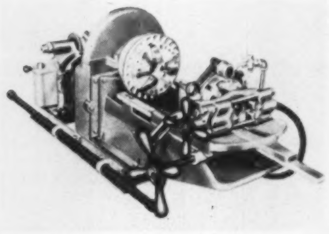
Venting Valve . . .

. . .for hot water heating, chilled water cooling systems—Maid-O'-Mist, Inc., 3217 N. Pulaski Rd., Chicago 41. Is automatic float operated type. Designed for vertical mounting only with ⅛ in. IP male connection. For pressures to 50 psi.



Differential Float . . .

. . .valve designed for *on-off* control—Klipfel Valves, Inc., Hamilton, Ohio. Is said to control ejector or motor driven pumps where pressure switch is used, maintain liquid levels in tanks and control ejection of gathered liquids. Toggle-latch mechanism locks valve open or closed until desired level has been reached. Direct operated valves in ⅜, ½, ¾, 1 in. sizes. Larger sizes pilot operating using direct operated type as pilot.



Threading Machine . . .

. . .designed for speed, portability—Beaver Pipe Tools, Inc., 310 Dana Ave., Warren, Ohio. Manufacturer states 40 percent productivity increase. Equipped with "Power Grip" wrenchless chuck engineered to further reduce chucking time, increase safety.

Convectors . . .

. . .with heating elements redesigned to utilize bronze headers, improved cabinet design to cut down installation time—Brown Products Co., 97-12 Metropolitan Ave., Forest Hills, N.Y. Front panels held in place by lateral steel brace welded to inside of front cover. This engages strut to hold cover panel in place, but permits removal.

The Invisible Enemy No.2

moves with incredible speed

In time of war it instantaneously devastates and obliterates with its searing heat, every human being within a tremendous radius, when released by a nuclear bomb. Though it has no temperature, its enormous energy changes into heat when it strikes and is absorbed by a surface.

Upon escaping from a building in winter, it leaves a chill behind. When it invades in summer, it takes its toll in excessive heat and human distress.

Its aliases are many—Infra-Red Rays, Heat Rays, Radiant Energy, Radiation.

It is responsible for 93% of the heat flow downward in summer through roof spaces; in wall spaces, for 65% to 80% of heat losses in winter, and heat flow inward in summer; for about 55% to 75% of heat loss upward in winter through ceiling and roof spaces.

Buildings are generally constructed with wall and ceiling air *spaces*, because the greatest flow of heat possible between two solids is by direct conduction—actual physical contact; and since air has low density, it allows little heat flow through it by conduction.

The enemy then becomes radiation in downward heat flow; and radiation and convection in upward and side heat flow.

A STALWART SHIELD

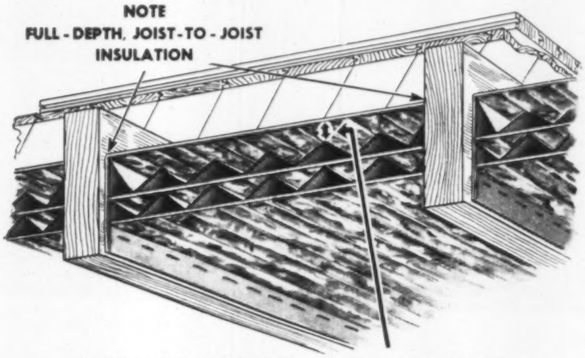
A shield against these enemies is multiple accordion aluminum. Its surfaces have an absorptivity to heat rays of a mere 3%; reflect them at the rate of 97%, and emit them at a rate of only 3%. Thus they retard the flow of heat rays outward or inward. Accordion aluminum is likewise a stalwart shield against the flow of heat by convection, its multiple layers of metal and fiber offering extremely effective resistance. Heat flow by conduction is minimized by its multiple layers of large air spaces, because they have slight density.

Scientifically separated sheets of aluminum, giving UNIFORM, full-depth protection to every inch of space between joists, will imprison the invisible enemy indoors in winter, prevent its invasion in summer, and transform it into a friendly and useful servant.

Its continuous metal sheets, up to 750 feet long, have almost zero permeability to water vapor. Infiltration under its flat, stapled flanges is slight. Its scientific construction minimizes condensation on or within this type of insulation.

More than 250 million square feet are in use today. For 10 years it has been repeatedly specified and used by many of the leading architects, engineers and builders of America.

Yours for the asking is a discussion of how and why aluminum insulates even under extreme conditions. It will be found in the booklet, "Thermal Test Coefficients of Aluminum Insulation for Buildings," published by the AMERICAN SOCIETY OF HEATING & AIR CONDITIONING ENGINEERS. Use the coupon for the literature and free samples of this scientific insulation.


NOTE FULL-DEPTH, JOIST-TO-JOIST INSULATION

NOTE FULL ONE-INCH EXTRA AIR SPACE

above accordion pleats for even more resistance to heat flow. Each sheet extends from joist-to-joist and through the flanges for permanent and extensive protection against flow of vapor, radiation, and convection.

COST OF EDGE-TO-EDGE INFRA
Multiple Aluminum Insulation
installed in new construction between
wood joists, material and labor

Type 6-PS about 10¢ sq. ft.
Type 4-PS about 8¢ sq. ft.

Infra Insulation, Inc., 525 B'way, N. Y., Dept. H-7
Please send ASHAE Booklet: "Thermal Test, etc."

Name____________________________

Firm____________________________

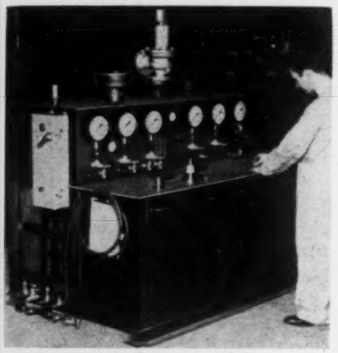
Address____________________________

EQUIPMENT DEVELOPMENTS

Continued

Air Filter . . .

. . . designed to remove smog irritants, odors—Philco Corp., Tioga and C Sts., Philadelphia 34. Of activated charcoal, glass fiber. Used in company's 1955 room air conditioners as original equipment. Furnishes high level of health protection for user, says company.

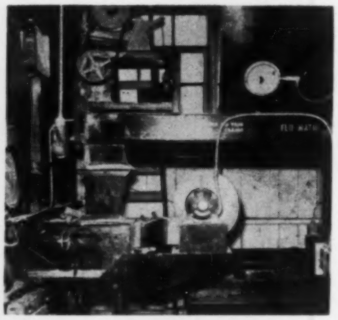


Testing Station . . .

. . . for safety valves—Farris Engineering Corp., 563 Commercial Ave., Palisades Park, N.J. Eliminates need for outside repair work. Provides for processing of maintenance valves. On skid mount for portability. Includes accessory equipment.

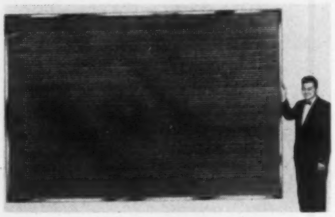
Cooling Tower . . .

. . . has combination redwood, steel construction—Dover Mfg. Co., P.O. Box 498, Independence, Mo. Requires no bolts for assembly. Steel parts are hot dip galvanized. In 3 to 15 ton models. Company will expand design to include all its natural draft towers.



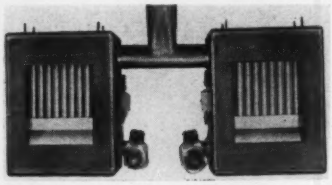
Industrial Stoker . . .

. . . for wood refuse fuel—American Coal Burner and Wood Stoker Corp., 18 E. Erie St., Chicago 11. Can be applied through front of existing boiler and arranged to extract, measure fuel from storage bin. Can also be equipped with transfer hopper to receive fuel from present conveyor or blow pipe system. Available for boilers 60 hp and larger.



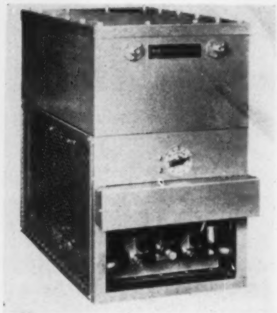
Return Air Grille . . .

. . . made as one piece assembly for any size opening—Titus Mfg. Corp., Waterloo, Ia. Eliminates butting together of smaller grilles. Curved, hemmed fins give 80 percent free area, says company. Cannot be seen through when used at lower wall areas.



Oil Fired Duct Heater . . .

. . . for use with commercial, industrial air cooling systems—Certified Furnace Corp., Box 1059, Trenton 8. Five sizes 110,000 to 220,000 Btu per hr output. Can be teamed up as tandem, shown, when higher outputs needed. Cited applications: to provide heater working with remote cooling unit when air moving blower is part of air conditioning system; as make-up fresh air heater where large quantities of air exhausted.

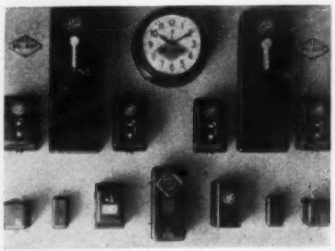


Air Driers . . .

. . . with outputs 4 to 55 cfm—Murphy & Miller, Inc., 1326 S. Michigan Ave., Chicago. In ¼, ¾, 1 ½, 3, 5 hp models. Designed to be automatic, to require no manual reactivation. Units mechanically refrigerated. Remove moisture by condensation process.

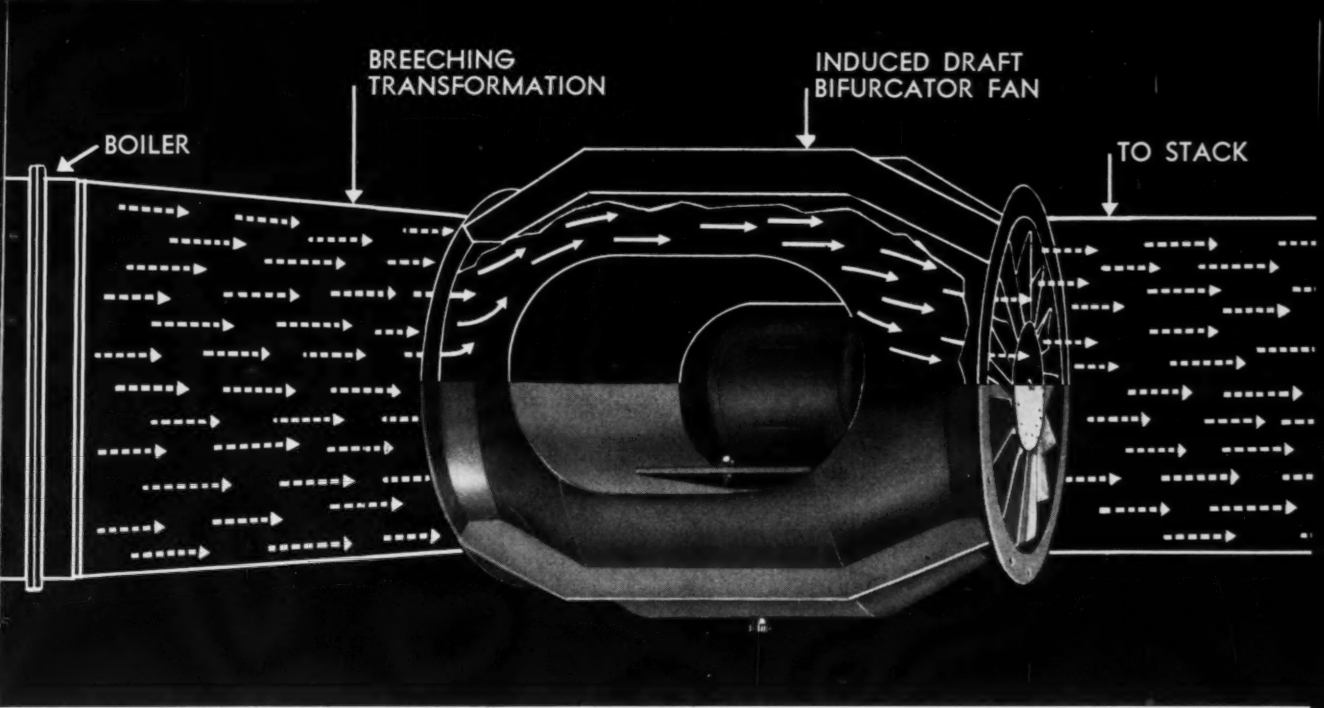
Aluminized Jacketing . . .

. . . for pipe—U.S. Rubber Co., Rockefeller Center, New York 20. Designed to be fire, acid, water resistant. Is aluminum foil laminated onto vaporproofed asbestos cloth. Can be used to cover pipe insulation. Requires no painting.



Panel Control Board . . .

. . . for company's line of stokers—Will-Burt Co., P.O. Box 913, Orrville, Ohio. Features standardized basis control circuits. Standard controls include disconnect switches, selector switches, hold-fire controls, programming clock. May also include shear pin alarms.

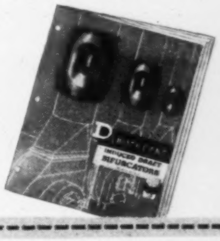


Provide controlled boiler draft this "common sense" way

Why go to the expense of erecting a tall stack? An Induced Draft Bifurcator fan gives you exactly what you want — positively controlled boiler draft in any weather.

It's also common sense to choose a fan that's not limited in the number of ways you can install it. The Bifurcator installs horizontally, vertically or at any angle that best fits the boiler room layout. It slips in anywhere, as conveniently as a flanged section of breeching. No parts to install separately, no platform to erect. A Bifurcator can even be mounted on the roof when there's a space shortage indoors.

This axial-flow fan has a divided housing, so flue gases bypass the motor, which always stays clean, cool and accessible. For high-pressure boilers delivering up to 60,000 pounds of steam per hour — and for low-pressure boilers rated up to 190,000 EDR. Send coupon for catalog.



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The most efficient method of combustion in steam generation!

Cyclotherm Steam and Hot Water Generators
18 to 500 hp
15 to 200 psi

Unequalled Heat Transfer Efficiency!

Cyclotherm Cyclonic Combustion guarantees a minimum 80% efficiency in oil and/or gas. Utilizes the largest possible heating area in the firetube. A flaming vortex spirals the length of the firetube. A thin layer of air prevents flame impingement . . . localized "hot spots" . . . and heat-retarding scale.

The Most Advanced Design!

Cyclotherm Cyclonic Combustion achieves its high heat transfer rate in only 2 passes. Permits a simplified design that reduces maintenance costs as much as 50%. Cyclotherm is as much as ⅓ smaller than other packaged units.

Completely Assembled On Arrival!

Factory-tested Cyclotherm costs less to ship because it's lighter in weight. Factory-insulation with fiberglas saves you up to $500 or $600. Installation requires only 5 connections. All parts necessary for safe, efficient, economical operation are supplied.

Automatic In Operation!

Electronic controls halt the Cyclotherm burner whenever operation is interrupted. A factory-pre-set water-level control automatically insures a sufficient supply of water always in the boiler. A low water cut-off control stops operation if the water supply is interrupted.

This free, information-packed booklet tells how Cyclotherm will help you achieve savings in time, costs and space. MAIL THIS COUPON TODAY!

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Cyclotherm Division, National-U.S. Radiator Corp.,
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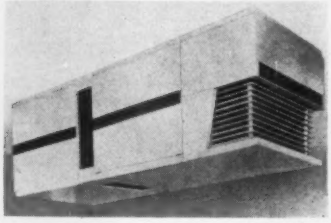
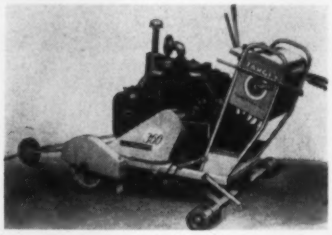
EQUIPMENT DEVELOPMENTS

Continued



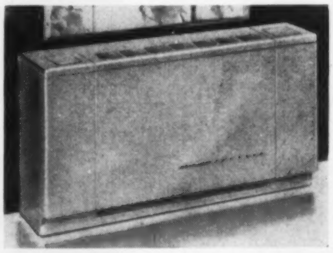
Air Conditioners . . .

. . . with package design requiring no floor space—General Electric Co., Bloomfield, N.J. Suspended from ceiling or shelf mounted. In water and air cooled models with 3, 5, 7½ ton capacities. Has hermetically sealed condensing unit.



Concrete Saw . . .

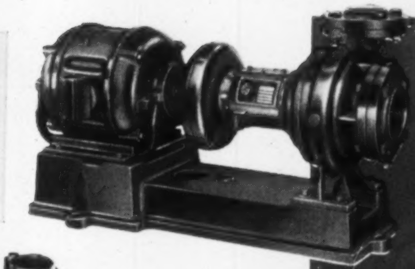
. . . powered with 36 hp, 4 cylinder engine—Robert G. Evans Co., 6315 Brookside Plaza, Kansas City, Mo. Self propelled. Operator can adjust speeds 1 to 25 fpm while saw in motion. Blade raises, lowers hydraulically.



Air Conditioners . . .

. . . with remote type cabinet design for heating, cooling—Fedders-Quigan Corp., Heating Div., Lalor and Hancock Sts., Trenton 7. For heating with circulating hot water, cooling with cold water from remote source. Are said to perform functions of ventilating, circulating, filtering, dehumidifying, also.

Depend on B&G FOR HEATING... COOLING ...AND PUMPING WATER



B&G 1531
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Specifying "B & G" throughout for water heating systems, air conditioning and refrigeration installations assures you of equipment known for quality—with a single manufacturer's responsibility for satisfactory operation.

If you haven't a complete file of the B & G literature shown here, write today.

B&G CENTRIFUGAL PUMPS

B & G Boosters and Universal Pumps cover a complete range of heads and capacities for forced hot water heating and service water systems. Noted for *quiet* operation!

For air conditioning, refrigeration and industrial applications, B & G 1522 and 1531 Pumps have a long record for dependable and economical performance. All pumps illustrated feature the B & G Leak-proof Mechanical Seal.

B&G EVAPORATOR

You'll find *plus value* in the unique design of this evaporator which prevents oil-trapping in the head passes. Steel legs are movable for easy mounting—shell connections extend well beyond the insulation cover. ASME Code constructed.

B&G CONDENSERS

Rugged, precision-built units of time-tested design provide top performance over a long service life. Built to ASME Code.

HEAT EXCHANGERS

Easy now to select equipment for water-to-water and steam-to-water heat transfer applications. B & G Type "SU" and "WU" Heat Exchangers are rated for instantaneous heating of water for service use—radiation—snow melting panels—swimming pools—boiler feed—storage tanks and process work. Many commonly used sizes of "SU" and "WU" Exchangers are available immediately from factory stock.

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COMPANY
Dept. DY-5, Morton Grove, Illinois
Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto

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AIR CONDITIONING PUMPS
with all others!

Compare COST

Check your cost against any other top quality air conditioning pump—size for size. You make big savings with Sta-Rite discounts.

Compare GALLONS OF WATER DELIVERED

Check TDH and efficiency, too. You get top hydraulic performance... more water with less power.

Compare EASE OF INSTALLATION

This pump is smaller, lighter in weight. Discharge outlet rotates to any of 4 positions. Mounting foot also rotates. Pump mounts at any angle for easy coupling and alignment.

Compare LONG LIFE

This trouble-free pump is constructed of top-quality materials, custom-engineered to assure long, dependable service. It eliminates service call backs, lets you keep your profits.

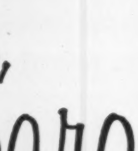
Yes, Compare

and you'll buy

STA-RITE

If you need small, lightweight pumps to fit modern, compact air conditioning equipment, check Sta-Rite. You can see pump superiority in the all-bronze closed impeller. And special 2-piece impeller construction assures friction-free channels, more capacity. Motors are full power, ball-bearing and capacitor-type, specially designed and made only for Sta-Rite pumps. Mechanical seal is positive, leak-proof. Single shaft is corrosion-resistant, requires no coupling, prevents alignment problems.

Ask your wholesaler, or write for his name and a copy of new bulletin describing Sta-Rite Air Conditioning Pumps.



STA-RITE

STA-RITE PRODUCTS, INC.
305 S. EIGHTH ST. • DELAVAN, WISCONSIN
Los Angeles, Calif. • Chamblee, Ga.
In Canada: STA-RITE Pumps (Canada) Ltd., Ajax, Ontario

EQUIPMENT DEVELOPMENTS

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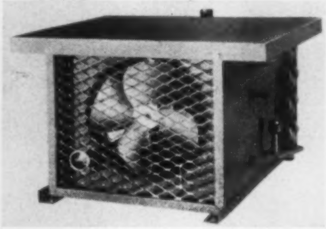
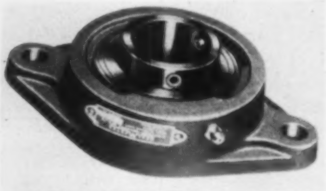


Unit Coolers . . .

. . . in single, double fan models for ceiling mounting—Refrigeration Appliances, Inc., 917-923 W. Lake St., Chicago. With capacity range 265 to 1400 Btu per hr per degree temperature difference. Cited features: built-in full size heat exchanger, electro-tin-plated copper tubes, balanced corrosionproof fan blades, heavy gage annealed galvanized steel housing, rubber mounted motor.

Chain Wrench . . .

. . . for pipefitters, maintenance men —Reed Mfg. Co., Erie, Pa. Is said to permit working in tight corners, between parellel pipe lines, close to baseboards, etc. In 10, 14, 18, 24, 36 in. lengths.



Ball Bearing Unit . . .

. . . with two bolt flange design— Stephens-Adamson Mfg. Co., Aurora, Ill. In shaft sizes $\frac{1}{2}$ to 2 3/16 in. Cited features: zone hardening, self alignment with locking pin and dimple, labyrinth seal.

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ENGINEERING MANUAL
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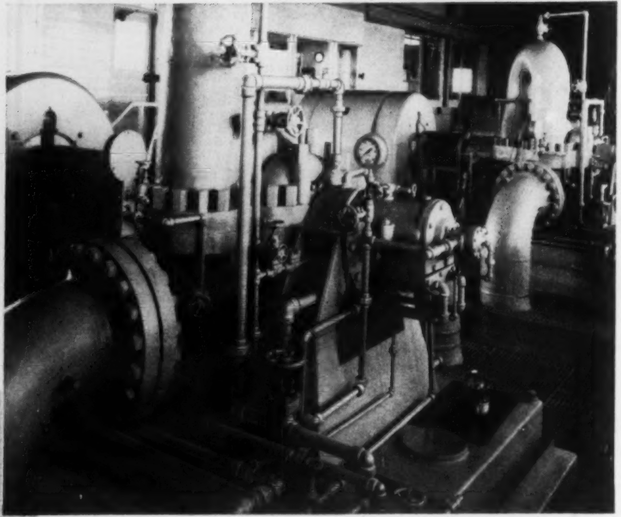
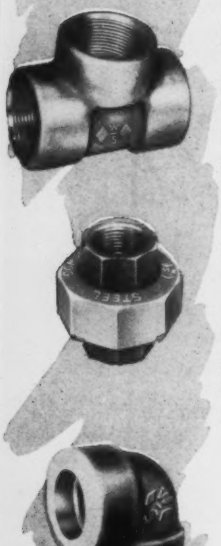
WATSON-STILLMAN

FORGED STEEL FITTINGS



WORK BEST...under pressure



In high pressure steam lines . . . process liquid and gas piping . . . hydraulic fluid lines . . . wherever strong, tough pipe joints are needed, Watson Stillman Forged Steel Fittings provide a safety factor against costly piping failures. They resist pressure, heat, corrosion, shock and vibration because they're drop-forged of high quality steel to produce a dense, tough, forged-fiber structure that can really take it.

Extra strength is built into W-S fittings in other ways too . . . such as the heavy reinforcing bands extending well beyond the threads or sockets.

Protect your high pressure piping system with Watson-Stillman Forged Steel Fittings. Available in carbon, stainless and alloy steels, in Screw-End and Socket-Welding Types to meet your service requirements. Send today for Free Catalogs.

Bulletin A3-50—Forged Steel Fittings
Bulletin S-1-55—Stainless and Alloy Fittings
Bulletin U-1—Forged Steel Unions
Bulletin S-3-55—150 lb. Stainless Fittings

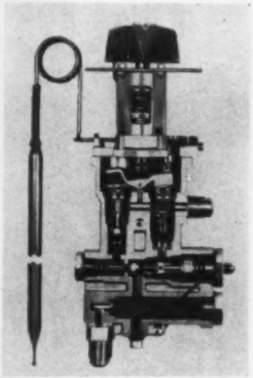
Sold Through Leading Distributors

WATSON-STILLMAN FITTINGS DIVISION

HKP H. K. PORTER COMPANY, INC.
Roselle, New Jersey

EQUIPMENT DEVELOPMENTS

Continued



Thermostatic Selector . . .

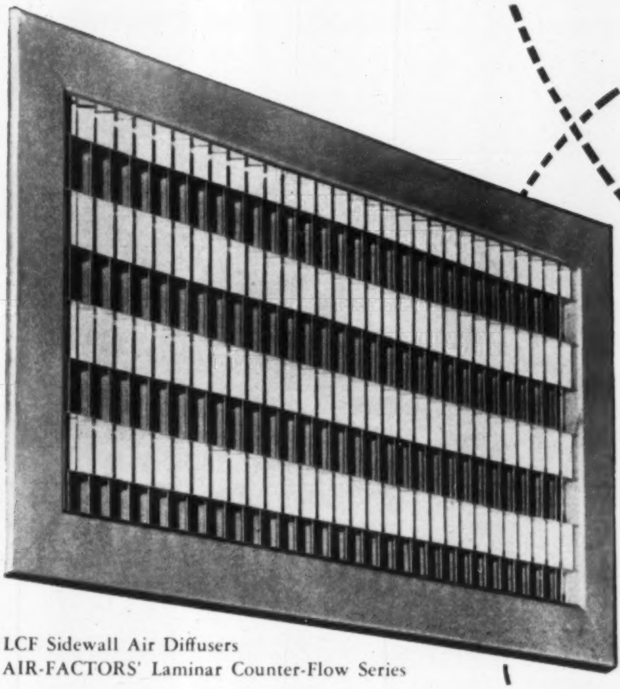
. . . valve for year 'round air conditioning systems—Detroit Controls Corp., 5900 Trumball Ave., Detroit 8. Changeover from summer to winter done thermostatically from temperature of incoming water. Needs no pneumatic lines, electrical connections. Adjustment knob, once set, provides consistent temperature, says company.

Flexible Cord Set . . .

. . . for room air conditioners—Accessory Equipment Dept., General Electric Co., Bridgeport, Conn. Made of thermoplastic insulating material. Green grounding conductor nested between other two conductors. When cord is ripped, green cord becomes exposed. Also in two conductor model for nongrounding applications.

Room Air Conditioner . . .

. . . is 1 ½ hp, 230 volt unit—General Electric Co., General Appliance Div., Appliance Park, Louisville. Designed to cool areas to 1000 sq ft. Has 4 pt per hr dehumidification capacity.



LCF Sidewall Air Diffusers
AIR-FACTORS' Laminar Counter-Flow Series

AIR-FACTORS INC

PROVIDES A SOLUTION...

where balanced air distribution and air control are essential...

UNUSUAL FACILITIES REQUIRED FOR POLIO AND OTHER COMMUNICABLE DISEASES

The segregation of visitors from patients is a major problem in a communicable diseases hospital. The plan developed by Adrian Wilson-Paul R. Williams, Architects Associated, provides a visitor's balcony surrounding the patient's rooms serviced by separate elevators. Communication is provided with the patient by view windows and telephones, preventing visitors from coming into contact with contaminated areas.

The visitor's balcony arrangement allows around the clock application of polio packs, the operation of "iron lungs" and other treatment without interference or inconvenience from visitors.

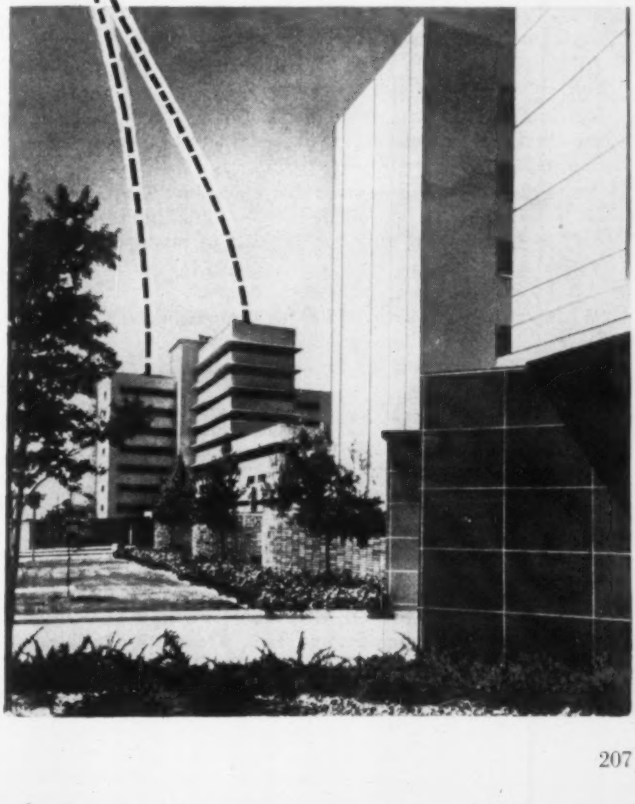
Similar major air conditioning problems were overcome by Hilburg, Hengstler and Turpin, consulting engineers, with their design of a 100 per cent fresh air double duct system that provided heat and refrigeration cooling to individual temperature controlled rooms, and the selection of Air-Factors' Model LCF Sidewall Air Diffusing outlets to provide the very necessary draftless air distribution.

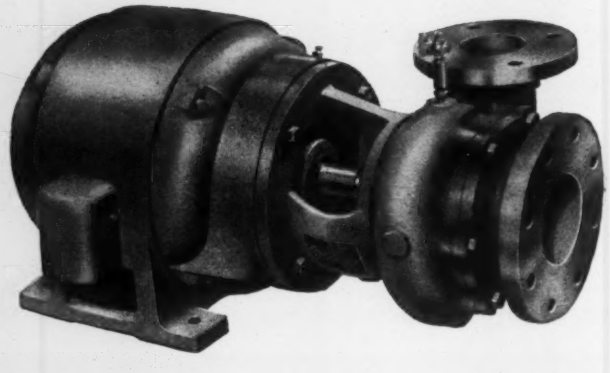
Write for literature

AIR-FACTORS INC
MONROVIA, CALIFORNIA
AIR DISTRIBUTION
AIR CONTROL

- The photograph below shows a section of The Communicable Disease Building, a part of the Los Angeles County General Hospital group . . . AIR-FACTORS' LCF Sidewall Air Diffusers were specified for the interior of this building.

ADRIAN WILSON-PAUL R. WILLIAMS, ARCHITECTS ASSOCIATED
HILBURG, HENGSTLER AND TURPIN, CONSULTING ENGINEERS
F. B. GARDNER CORP. AIR CONDITIONING CONTRACTOR





"A LOT OF PUMP IN A LITTLE SPACE!"

"Buffalo" Close-Coupled Clear Water Pumps

When you want to move as much as 1100 gallons of water per minute in a cramped installation, pick a "Buffalo" Close-Coupled Pump. You'll find it's just what the users call it — "a lot of pump in a little space".

Here's an example. One of our 4" pumps, delivering 600 gpm at a 60-ft. head on only 15 BHP, takes less than 2 cu. ft. of space and is slightly over 2 ft. long.

All other sizes, from 1" to 6" discharges, are proportionately compact and efficient.

Installation, of course, is simple. You have a unit package, with shaft pre-aligned — permanently. The pump can be easily adjusted to the desired discharge angle.

There are many other reasons that make any "Buffalo" Pump you buy *"a lot of pump"*. There's efficiency — durability — and the "Q" Factor* of Quality that only our 78 years of pump engineering can produce.

Write today for Bulletin 975-D for complete details.

"Buffalo" PUMPS

**The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.*

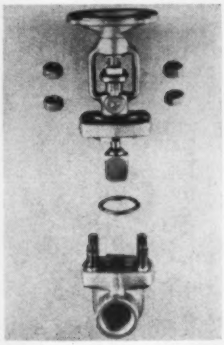
BUFFALO PUMPS, INC.

171 Mortimer St., Buffalo, N. Y.
SUBSIDIARY OF BUFFALO FORGE COMPANY
Canada Pumps, Ltd., Kitchener, Ont.
Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

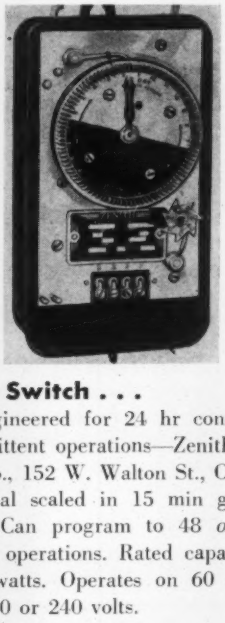
EQUIPMENT DEVELOPMENTS

Continued



Gaskets . . .

. . . incorporated in small forged steel gate valves to 2 in.—Flexitallic Gasket Co., 918 N. 8th St., Camden 2, N.J. Valve manufactured by Worcester Forged Steel Valve Co. Gasket compression controlled by holding close tolerances on body recess and bonnet raised face. Design is said to lengthen life of gasket joint.



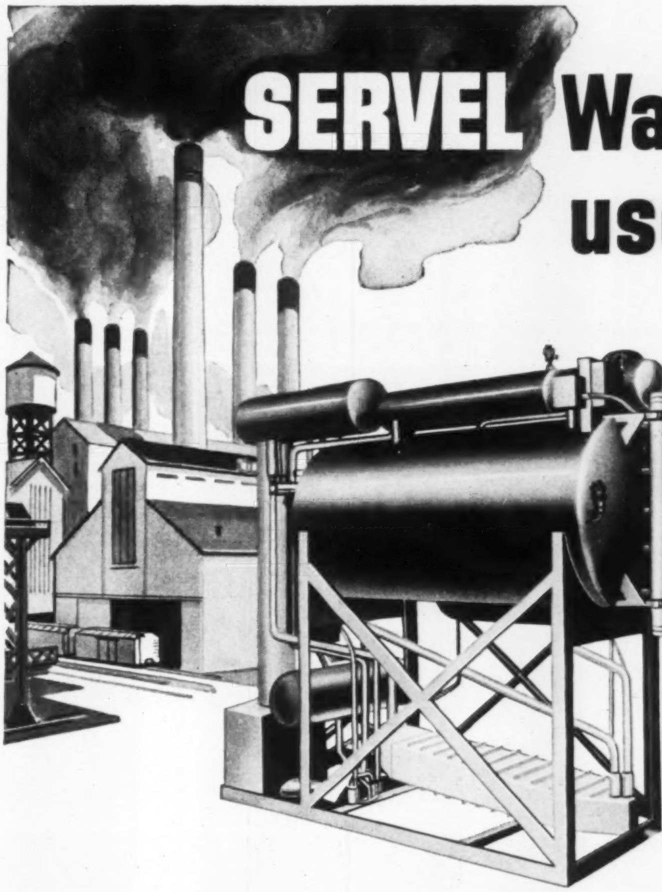
Time Switch . . .

. . . engineered for 24 hr control of intermittent operations—Zenith Electric Co., 152 W. Walton St., Chicago 10. Dial scaled in 15 min graduations. Can program to 48 *on* and 48 *off* operations. Rated capacity is 1000 watts. Operates on 60 cycles, a-c, 110 or 240 volts.

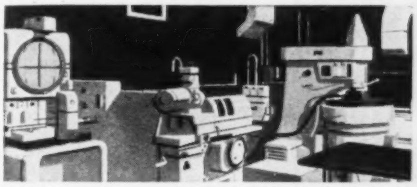
Combination Fitting . . .

. . . for hydraulic pressures—Flodar Corp., 1366 E. 45th St., Cleveland 3. Designed to make perfect joint since tubing is internally supported by wedge insert on which self flare is made as nut is tightened.

SERVEL Water Chillers use waste heat



to provide low-cost chilled water



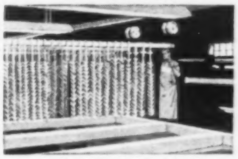
Industrial pre-cooling—Helps you increase capacity and improve performance of air compressors and internal combustion engines.

Turn waste into work and costs are bound to go down. That's just what Servel Water Chillers will do for you.

Servel's exclusive absorption principle uses waste heat (or steam) from any source to provide chilled water and at controlled temperatures. It gives you a cooling agent for air conditioning . . . or for hundreds of process applications.

These efficient units have no moving parts. Give you vibration-free operation and low upkeep. Compact size and low floor loading permit single or multiple installations in the most advantageous locations. You can locate them overhead . . . or outside of the building. What's more, you save the high cost of heavy-duty wiring.

Check these advantages against *your* cooling needs. Your Servel dealer will gladly supply details and engineering help. Or mail coupon today.



Process cooling — Here's matchless control for manufacturing and formulating processes. Regulates temperatures to precision limits.

Air conditioning—Gives you economical humidity and temperature control. Operates efficiently from cheapest fuels . . . even waste heat.

Send coupon for details, now!

Servel

the name to watch for great advances in

AIR CONDITIONING ✓ REFRIGERATION

SERVEL, INC., Dept. HP-75 Evansville 20, Indiana

Please send me specifications and full information on Servel Water Chillers.

Name____

Firm____

Address______________________________________

City________________________ Zone____ State________

Any way
you look
at it...

Yes, look at this WEINMAN Pump *any* way you choose . . . from the standpoint of compact size . . . the way it mounts easily in any position to facilitate installation where space is limited . . .

. . . compare the matchless, long-lived efficiency and low unit cost . . . and you'll choose WEINMAN Centrifugal Pumps for all hot or chilled water circulating tasks.

When you choose WEINMAN Pumps, you benefit from over a full quarter-century of pump experience; you are assured of obtaining superior service and efficiency from your WEINMAN Centrifugal Pumps at no greater cost than ordinary pump units which offer far less. Get the expert advice of a WEINMAN Centrifugal Specialist when pump problems come up . . . he's the man that can help you solve your pump problems! Write, wire or phone today.

The WEINMAN Type AC close-coupled pump will give longer, thoroughly dependable service even when cooling water is loaded with abrasive grit . . . a rotary type mechanical seal, with a reversible ceramic floating seat and carbon washer combination held by a stainless steel spring, gives long leakproof operation. Rust and corrosion proof solid stainless steel shaft. For full details, ask for Bulletin 725.

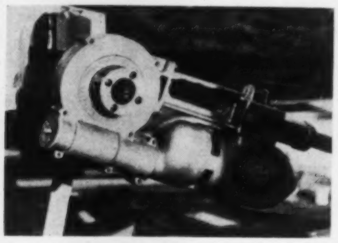
Representatives in principal cities

Built by Centrifugal Specialists

The WEINMAN Pump Mfg. Co.

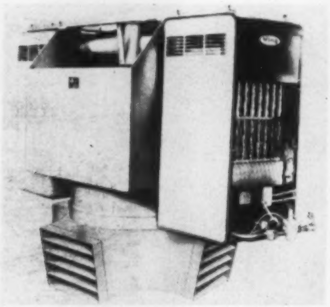
EQUIPMENT DEVELOPMENTS

Continued



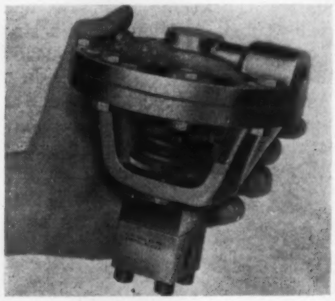
Power Pipe Threader . . .

. . . with portable design for on the job threading—Velocity Power Tool Co., 201 N. Braddock Ave., Pittsburgh. Adaptors, speed reducer make possible threading pipe 1/4 to 10 in., says company. Weighs 20 lb. Constructed for one hand operation. Equipped with 3/4 hp electric motor, toggle switch for reversible power. Tool may be used as auger, for driving bolts and nuts, opening valves, as hoist for weights to 500 lb, manufacturer reports.



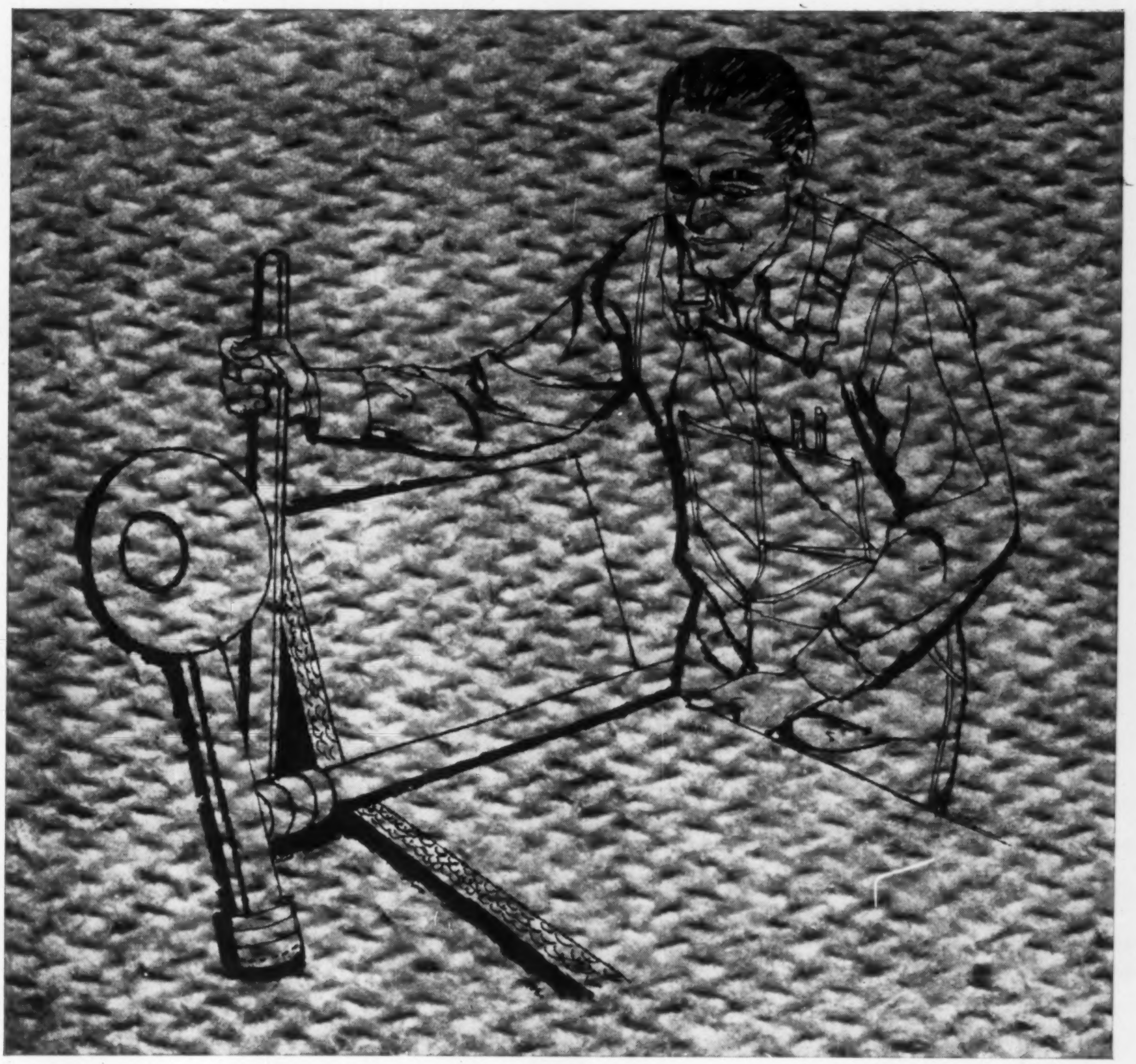
Gas Fired Heater . . .

. . . is ceiling suspended, downward discharge type—L. J. Wing Mfg. Co., 140 Vreeland Mills Rd., Linden, N.J. Is self contained unit combining gas burners, combustion chamber and heat exchanger with motor driven fan and fixed or revolving discharge outlets. Has 430,000 Btu per hr input capacity.



Control Valve . . .

. . . designed to provide low hysteresis, quick response on service to 1000 psi at 350 F over 3 to 15 psi control range —George W. Dahl Co., 430 High St., Bristol, R.I. Of stainless steel and Teflon materials. Direct or reverse acting, top mounted positioners available. In five sizes of linear, equal percentage or quick opening plugs.



Pittsburgh Superfine Fiber Glass speeds ductwork insulation

Wrap or liner, the use of Pittsburgh Superfine Fiber Glass will cut installation time—and provide the finest thermal insulation and sound absorption qualities. Lightweight, easy to handle, this soft, flexible fiber glass can be quickly cut with knife or shears to fit any sizes or shapes. It can be formed with the sheet metal or installed after fabrication. Applied with adhesives or tapes, with or without screws or clips, PPG Superfine saves money on installation.

Available in a wide range of roll lengths and widths and in all required thicknesses . . . unfaced or with cloth, asbestos, paper, aluminum foil or vinyl facings. For complete information write our executive offices or district sales offices in Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, New York, Philadelphia or St. Louis. Pittsburgh Plate Glass Company, One Gateway Center, Pittsburgh 22, Pennsylvania.

FIBER PPG GLASS

PAINTS · GLASS · CHEMICALS · BRUSHES · PLASTICS

PITTSBURGH PLATE GLASS COMPANY

BARBER COLMAN

Wheelco Instrument Service

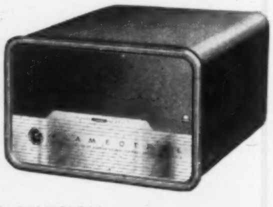
IN ALL PRINCIPAL CITIES

. . . to help you specify, design, and install combustion safeguard systems !

With today's improved methods for safeguarding oil- and gas-fired furnaces and boilers, consulting engineers find it profitable to work with instrument specialists. Through its nation-wide sales and service organization, Wheelco offers engineering assistance and instrument "know-how" aimed at helping you select *the* combustion safeguard system best suited to every job. And, because these specialists have a *complete line* of instruments and accessories to choose from, their recommendations are based on impartial analysis of your customer's requirements and broad experience in solving a variety of control problems. So, make your Wheelco field engineer a partner in designing and specifying combustion safeguard systems.

New FLAME-OTROL

Manual and automatic models bring you many improvements, including "plug-in" chassis, new safety-type terminal strip, "safe-start" operation, and convenient external test points to simplify circuit and voltage checking. Available with all conventional industrial-type sensing systems for improved flame supervision with gas, oil, or combination gas-oil firing. Bulletin F-6570.



WHEELCO INSTRUMENTS DIVISION

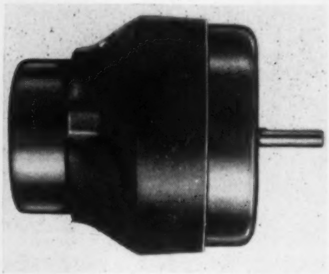
Barber-Colman Company

Dept. S, 1501 Rock Street, Rockford, Illinois
BARBER-COLMAN OF CANADA, LTD., DEPT. S, TORONTO, ONTARIO, CANADA

Industrial Instruments • Automatic Controls • Air Distribution Products • Aircraft Controls • Small Motors
Overdoors and Operators • Molded Products • Metal Cutting Tools • Machine Tools • Textile Machinery

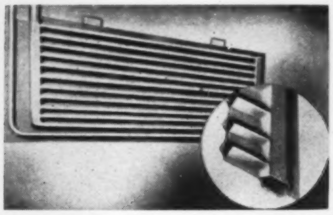
EQUIPMENT DEVELOPMENTS

Continued



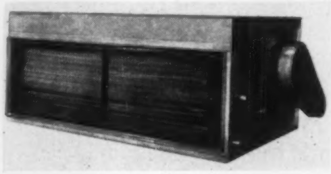
Shaded Pole Motor . . .

. . . features extended life, quiet operation, wide speed ranges—Electric Motors and Specialties, Inc., Garrett, Ind. Rated 1/60 to 1/30 hp. Operates 1550 to low as 400 rpm. Has unit bearing construction, unique lubrication system, says company. Totally enclosed.



Heat Transfer Unit . . .

. . . fabricated of two metal sheets with embossed fluid passage—Tranter Mfg., Inc., Lansing 4, Mich. Two styles have header construction for vapor phase medium. Third style has serpentine passages for liquid heating, cooling media. Lightweight design for easy cleaning, repair.



Glycol Defrost Coolers . . .

. . . for low temperature defrost applications—Bush Mfg. Co., 179 South St., West Hartford 10, Conn. In ceiling hung (shown), floor mounted models. Feature inner fin coil construction to permit defrost from inside.

BARBER COLMAN

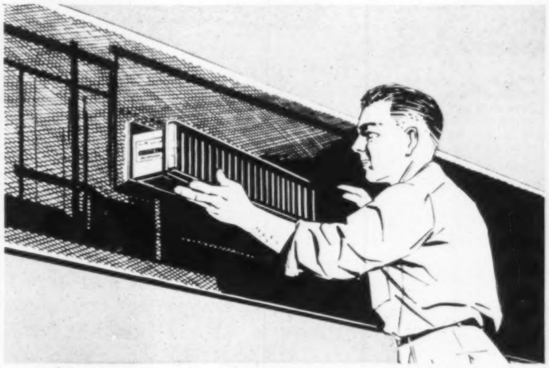
Uni-flo
Engineered Air Distribution

High velocity for space-saving air distribution

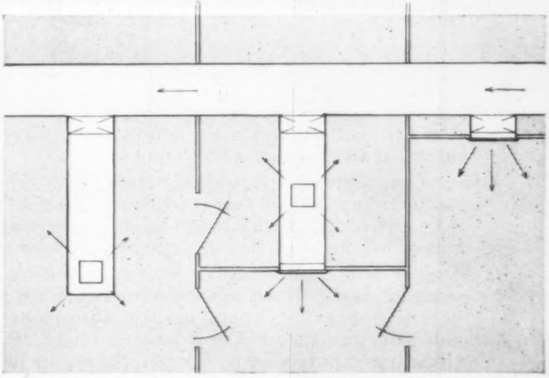
Contemporary design of the new Texas Eastern Transmission Corporation office building contributes to the beauty of the Shreveport, Louisiana skyline. This modern 14-story building is the home office of an organization which, in less than a decade, has become one of the major natural gas transmission companies in the country. Individual room fan coil units, using chilled and hot water, provide year-round air conditioning. Outside air for ventilation is supplied through a space-saving high velocity system.

Texas Eastern Transmission Corporation Office Building, Shreveport. *Architects:* NEILD-SOMDAL-ASSOCIATES, Shreveport. *Consulting Engineers:* CARY B. GAMBLE & ASSOCIATES, New Orleans. *General Contractor:* J. A. JONES CONSTRUCTION CO., Shreveport. *Mechanical Contractors:* HUFFMAN-WOLFE SOUTHERN CORP., Atlanta.

Attractive appearance of the Barber-Colman air distribution equipment appealed to the architect. Uni-Flo Sidewall Diffusers provide efficient distribution of the air, free from drafts and disturbing noise. Each diffuser is individually adjustable for simplified balancing of the system.



Uni-Flo Air Valve can be installed directly behind the grille to reduce high velocity air to conventional velocity for distribution. Air valve is adjustable through grille opening.



Flexibility of Uni-Flo Air Valve permits installation at junction of high velocity trunk ducts with conventional velocity branch ducts to supply several diffusers.

BLAZING THE TRAIL TO BETTER AIR DISTRIBUTION

First with high velocity air valves, accessories

Since 1947, when Barber-Colman introduced the Uni-Flo Air Valve (used in the above office building), the space-saving benefits of high velocity air distribution have encouraged applications throughout the nation. High velocity makes the use of smaller ducts possible. The patented air valve transforms high velocity air to low velocity near point of room entry, with minimum turbulence and noise. Engineering help on high velocity applications is yours by calling our nearby Field Office, or writing us.

Barber-Colman Company

Dept. S, 1101 Rock Street, ROCKFORD, ILLINOIS, U. S. A.

Field Offices in Principal Cities

Air Distribution Products • Automatic Controls • Industrial Instruments Aircraft Controls • Small Motors • Overdoors and Operators • Molded Products • Metal Cutting Tools • Textile Machinery

Since 1937 over 700 Janitrol Unit Heaters installed in

INTERNATIONAL—HARVESTER PLANTS

Janitrol's trouble-free service results in re-specifying for 17 years!

Photographs show International Harvester's Denver plant, one of many that is Janitrol equipped to provide ideal working conditions.

Experiences, like International Harvester's, with Janitrol dependability speak more eloquently than any mere advertising claims.

Part of Janitrol's superior performance is easily understood by this record: less than ¼ of 1% of over a million Janitrol heat exchangers installed since 1940, have failed from any cause.

If quiet operation, coupled with fast heating response and built-in safety controls are features you want . . . then, Janitrol should be your selection for your best heating buy. Call a local Janitrol factory-authorized dealer, he is listed under "Unit Heaters", yellow pages, your phone book.

Write today . . .
Get your copy of the "Businessmen's Blue Book of Better Heating", it's full of useful information on the proper installation of unit heaters.

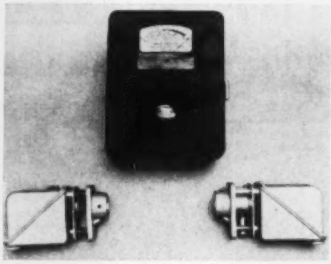
Janitrol
GAS-FIRED UNIT HEATERS

Janitrol Heating
& Air Conditioning Division
Surface Combustion Corporation
Columbus 16, Ohio
In Canada: Alvar Simpson Ltd.
Toronto 13

ALSO MAKERS OF Surface INDUSTRIAL FURNACES AND Kathabar HUMIDITY CONDITIONING

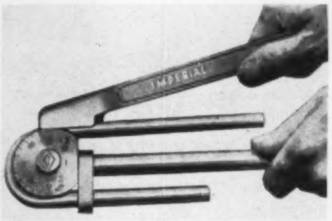
EQUIPMENT DEVELOPMENTS

Continued



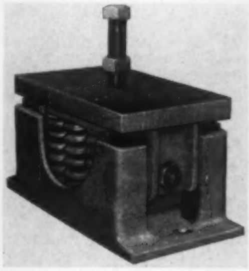
Smoke Density . . .

. . . indicator system—Electronics Corp. of America, 720 Beacon St., Boston 15. Consists of light source, photoelectric scanner, smoke density indicator. Smoke obscuring light beam aimed at scanner measured in terms of density and Ringelmann Number. Company's recorders may be used with system to record conditions over 24 hr period.



Benders . . .

. . . for hard, soft tubing—Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago 7. Will bend hard drawn copper, stainless steel tubing, manufacturer states. Need no clamps to keep tube from slipping. Bend to 180 deg angles. Each bender handles one size of tubing.

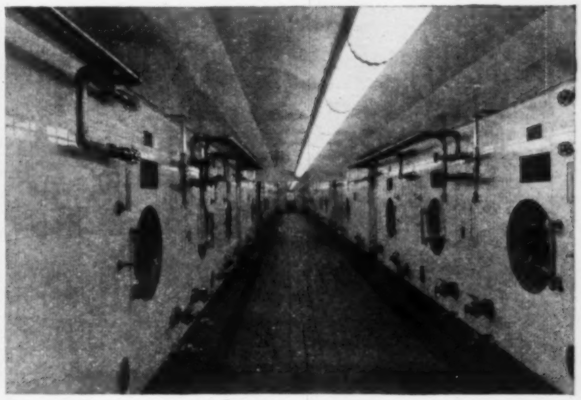


Vibration Isolator . . .

. . . designed to carry over 17,000 lb —Korfund Co., Inc., 48-01-F 32nd Pl., Long Island City 1, N.Y. Hous-

Dry air saves brewery $10,000/yr.

Before: A familiar view of fermentation tanks without Kathabar humidity conditioning



After: Kathabar humidity conditioning eliminates condensation, adds maintenance savings to its other benefits.

One of our best-known breweries recently saved an extra $10,000 a year in its fermentation cellars, by using Kathabar units instead of cooling units.

Previously, condensation damage forced them to repaint their cellars every 3 years at a cost of as much as $40,000. They figure that their Kathabar system – which dries air below the condensation point – eliminates every other painting.

But that's only part of the story. Brewery officials expect less routine maintenance and fewer wash-downs. Corrosion of piping and instruments is eliminated. Building life will be extended.

Kathabar humidity conditioning has proved its cost reducing capacity in several of the largest breweries. Put it to work earning for you.

write for the complete brewery story today

Kathabar®
HUMIDITY CONDITIONING

SURFACE COMBUSTION CORPORATION, TOLEDO 1, OHIO

Greatly increased "human load" easily offset by KOOLSHADE®

—costly air conditioning change is eliminated

Problem: Investors Syndicate Corporation, new tenants on the first floor of the WCCO Building in Minneapolis, brought heavier traffic than had previously occurred in the space. The increased "human load" pushed the building's air conditioning needs to 37 tons—more than the existing plant could safely supply. It seemed the system would have to be enlarged or replaced.

Solution: Calculations proved that KoolShade Sunscreen applied to the south windows would cut the requirement to 24.7 tons. This 34% saving of 12.3 tons would bring the load well within the capacity of the existing unit. KoolShade was applied. Not only have general results proved highly satisfactory, but workers near the south windows report marked relief from the sun's heat and glare.

This installation proves again that when unexpected factors render an existing cooling unit inadequate, or when you are remodeling to accommodate air conditioning, or designing a new air conditioned structure, it pays to investigate the savings possible with KoolShade Sunscreen.

Only KoolShade Sunscreen offers

- **unsurpassed shading efficiency**—keeps up to 87% of the sun's rays off windows during the hottest part of the day—100 sq. feet of KoolShade reduces air conditioning approximately 1 ton.
- **80% clear visibility**—admits maximum glareless light.
- **harmony with all architecture**—improves building's appearance.
- **virtually no maintenance**—constructed of strong preoxidized bronze strips, wired and framed together, lasts for years, withstands hard blows.

Send today

for this detailed and illustrated bulletin. And for expert help in cutting costs and sun problems, just request a call from a KoolShade engineer. No obligation or charge.

Distributor franchises still open in many communities for those who qualify.

115-55

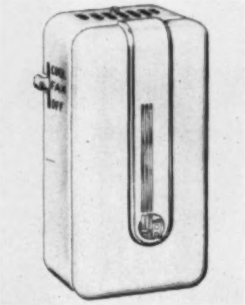
KOOLSHADE® Sunscreen

REFLECTAL CORPORATION
A subsidiary of Borg-Warner Corp.
310 S. Michigan Ave., Suite 2870,
Chicago 4, Ill.

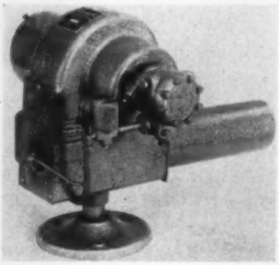
ALFOL INSULATION

INGERSOLL ROOF DECK

ing is specially annealed, malleable iron casting for heavy duty service, says company. With external, internal adjustments for leveling bolt.

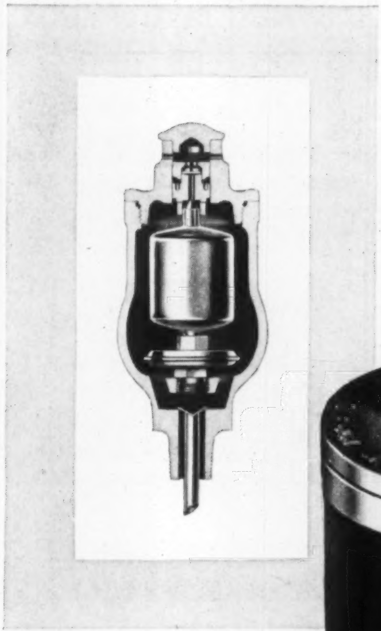


Thermostat . . .
. . . for air conditioning applications features "cooling anticipation"—White-Rodgers Electric Co., 1209 Cass Ave., St. Louis 6. Small resistor placed in parallel with cycling contacts makes possible to maintain closer room temperatures, says company. Units also available with manual selector switch.



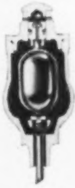
Oil Burners . . .
. . . designed for high combustion service—Quiet Automatic Burner Corp., 33 Bloomfield Ave., Newark 4. Developed by Shell Oil Co., licensed to Quiet Automatic for manufacture. Type KA-SH has ¾ to 2 gph capacity; KA-1-SH has 6 gph capacity. With newly designed combustion head, delayed action oil valves.

Direct Fired Heaters . . .
. . . with stainless steel construction—Arthur A. Olson & Co., Canfield, Ohio. Gas or oil or gas-oil fired.

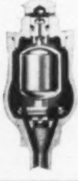


No. 5 Rapid Vent. Float and thermostatic construction. Designed for use at the end of steam mains, tops of risers and other similar locations on vapor and one pipe vacuum systems where the maximum venting requirement does not exceed one cubic foot per minute at 5 psi.

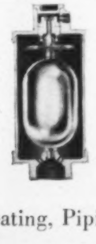
No. 6 Quick Vent. Thermostatic only. Designed for installation at high points in the piping where there is not sufficient room for the No. 5 Vent or where a float is not needed. Same venting capacity as No. 5.



No. 50 Air Vent. Float only. Designed to remove air and gases automatically from hot or cold water tanks, coils or piping, liquid pump systems or similar applications where it is necessary to vent air rapidly. Maximum working pressure, 125 psi.



No. 55 Air Vent. Float and thermostatic construction. Is capable of expelling large volumes of air without passage of water or steam and is designed for use on steam pressure vessels or systems. Maximum working pressure, 125 psi.



No. 7 Air Eliminator. Float and thermostatic construction. Expecially suitable for installation at the ends of steam mains, return piping and tops of risers where it is necessary to expel a large volume of air from the system. Suitable for working pressures up to 15 psi.

A well placed air vent can work a heating miracle!

In a Wilmette Illinois Building, an outwardly well-engineered vacuum system had been a headache for years. Then, last winter, along came a heating man who quickly sized up the situation and said with real conviction: "Put a Marsh No. 5 Vent right there!"

That did it! One inexpensive vent cleaned up a spotty, erratic condition, that a number of expensive alterations had failed to touch.

Unusual? Not in the least: over the years we have seen a lot of wonders worked by installing the right kind of Marsh air vent in the right spot. A number of these dependable vents are illustrated here . . . products that express an unrivaled accumulation of knowledge in dealing with air venting problems.

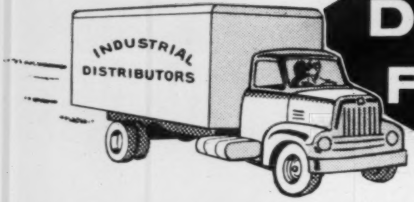
Marsh air vents are fully covered by the Marsh Heating Specialty Catalog along with Marsh Traps and Valves. Your local Marsh man will be glad to work with you in applying Marsh Vents effectively.

MARSH HEATING EQUIPMENT CO.
Sales Affilate of Jas. P. Marsh Corporation
Dept. T, Skokie, Ill.
Marsh Instrument & Valve Co. (Canada) Ltd., 8407 103rd Street, Edmonton, Alberta, Canada

MARSH

Quality Heating Specialties since 1865

SPECIFY
DEMING
PUMPS



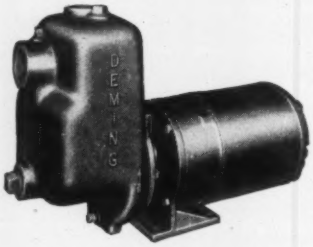
FOR PROMPT DELIVERY!

Practically every point in the U.S.A. is within short distance of a Deming Distributor. This nationwide network of distribution works to your advantage when prompt delivery is essential to your scheduled operations.

DEMING "MOTOR-MOUNT" PUMPS

FIG. 3350

Self-Priming "Motor-Mount" Centrifugal Pumps. Especially adapted for air conditioning service. Also efficient for swimming pools, lawn sprinkling and general industrial pumping services. The line covers the range from ½ through 5 H.P. for capacities through 127 G.P.M. at heads from 10 to 110 ft.



FIGS. 4350-4355

These "Motor-Mount" Centrifugal Pumps are designed for air conditioning and other applications requiring compact, dependable pumping units at minimum cost.

Available in sizes from ½ through 5 H.P. Capacities range from 10 through 200 G.P.M. against heads from 10 to 100 ft.

All Deming "Motor-Mount" Centrifugal Pumps are designed to permit having the discharge nozzle in horizontal, vertical or angular position.

Send for Free Bulletins

General specifications, performance tables and related data on Deming "Motor-Mount" Centrifugal Pumps are included in Bulletin No. 3350 and Bulletin 4355A. Your request for free copies will be answered promptly.

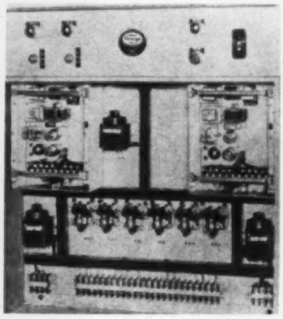
75th ANNIVERSARY
DEMING
PUMPS
1880 · 1955

THE DEMING COMPANY
560 Broadway • Salem, Ohio

EQUIPMENT DEVELOPMENTS

Continued

With capacities 300,000 to 2 million Btu output. Combustion chamber has floating design to cut down expansion, contraction stresses. Control circuit is 110 volts.



Control System . . .

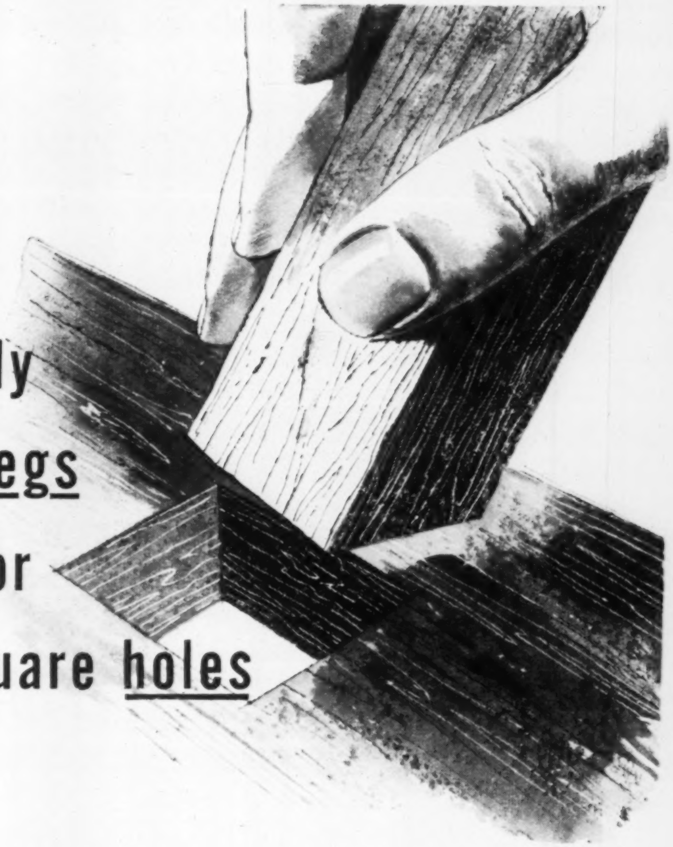
. . . designed for safe light-off and operation of multiple burner boilers —Electronics Corp. of America, 720 Beacon St., Boston 15. Consists of prewired, tested control cabinet assembly, shown, plus controls, timers, valves, etc. for complete installation. Is said to provide starting, operating flame failure protection for one to four burners, gas or oil or gas-oil fired.

YARWAY
H
L
LIQUID LEVEL
INDICATOR

Liquid Level Indicator . . .

. . . is electronic secondary remote unit for use with company's primary unit—Yarnall-Waring Co., 107 Mermaid Ave., Philadelphia 18. Primary indicator actuated by manometric differential pressure. Secondary indicator electrically connected to primary unit. Can be installed up to 5000 ft from primary, says company.

Brunner makes only square pegs for square holes



. . . and round pegs for round holes, too! Brunner's wide range of refrigeration equipment makes it possible for your customers to have the right type and size of units for their specific refrigeration requirements. They don't need to settle for something that's either too large or too small for the job.

You can sell Brunner with full confidence that your customers are getting the *right* unit for the *right* job . . . the most dependable refrigeration that money can buy.

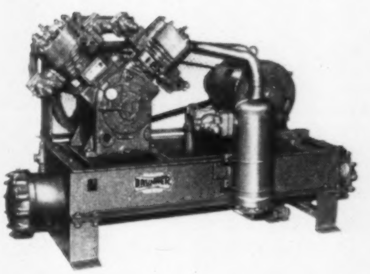
"BRUNNER" MEANS BIGGER PROFITS FOR YOU

The completeness of the Brunner line opens the door to bigger profits for you. There are Brunner Refrigeration Condensing Units for every commercial and industrial application . . . big or small.

They're noted for dependability . . . durability . . . easy installation and maintenance . . . and they cost less to operate than many other units of similar capacities.

See your Brunner Representative, or write to:

BRUNNER MANUFACTURING COMPANY
Dept. L-755, Utica, N.Y.
The Brunner Co., Gainesville, Ga.
In Canada:
Brunner Corp. (Canada) Limited, Toronto, Ontario



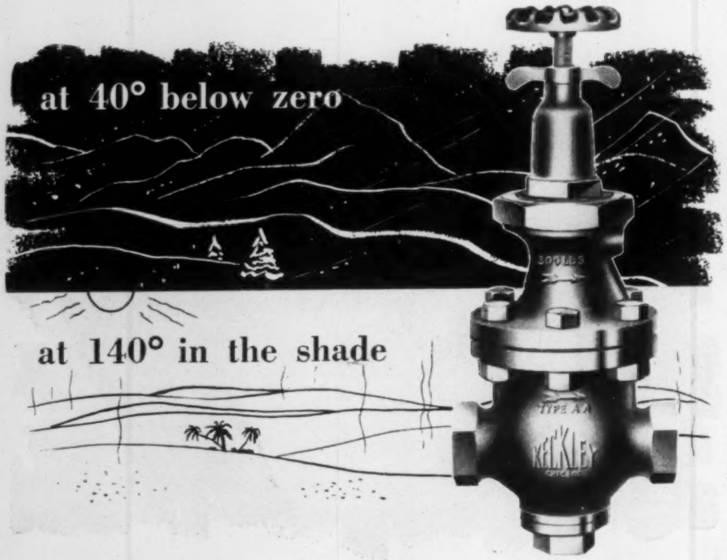
BRUNNER CONDENSING UNITS

. . . range from ¼ H.P. to 75 H.P. for high, medium, low and extremely low temperature work. They're easy to install . . . easy to service on the job!

BRUNNER
SINCE 1906

BRUNNER EXTRAS

- Compressor Experience
- Product Research
- Design Engineering
- Wide Product Range
- Proven Quality
- Complete Dependability
- Easy Servicing
- Warranted Performance
- Nearby Distributor Service
- Profit Opportunity
- Advertising Support
- Sales Promotion Help



. . . Regardless of ambient temperature, this Keckley air and gas pressure regulator is guaranteed to give:

POSITIVE DEAD END SHUT-OFF

All Keckley pressure regulators used in air and gas systems can be fitted with Teflon seats and discs, thus assuring positive shut-off no matter the outside temperature. The resiliency of Teflon is not affected by ambient temperature changes, thus guaranteeing dead end service. These pressure regulators are naturals for air and gas service to 600 lbs. under all temperature conditions when all moisture has been removed from the air or gas.

When handling high temperature or high pressure steam (to 300 lbs.), the regulators can be fitted with a monel piston and liner and a Stellited stainless steel seat and disc. For normal installations stainless steel main valve and seats are standard and are used on steam, gas or air.

Size range ½″ through 6″, bronze or semi-steel body; screwed or flanged connections.

No matter what requirements you have, a Keckley pressure regulator can be engineered to fit them. See your local Keckley Representative or write for details. Ask for the free 56 page Catalog 55-F — contains complete information about all Keckley Steam and Liquid Controls.

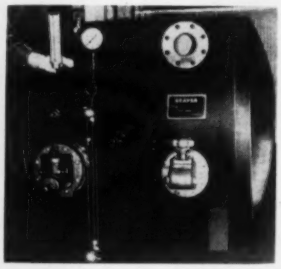
O. C. KECKLEY COMPANY
400 W. MADISON ST.
CHICAGO 6, ILLINOIS

KECKLEY CHICAGO

Pressure Regulators • Temperature Regulators • Float Valves
Strainers • Solenoid Valves • Reducing Valves
Pop Safety Valves • Relief Valves

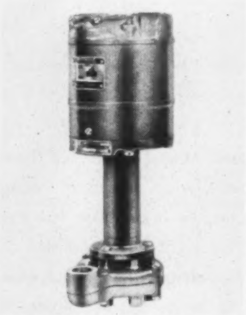
EQUIPMENT DEVELOPMENTS

Continued



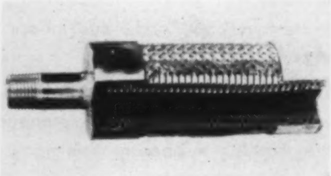
Deaerating Heater . . .

. . . for small plants where space economy necessary—Graver Water Conditioning Co., 216 W. 14th St., New York 11. Designed to remove noncondensable gases to cut down corrosion. Is two stage, spray type heater with internal vent condenser of stainless steel.



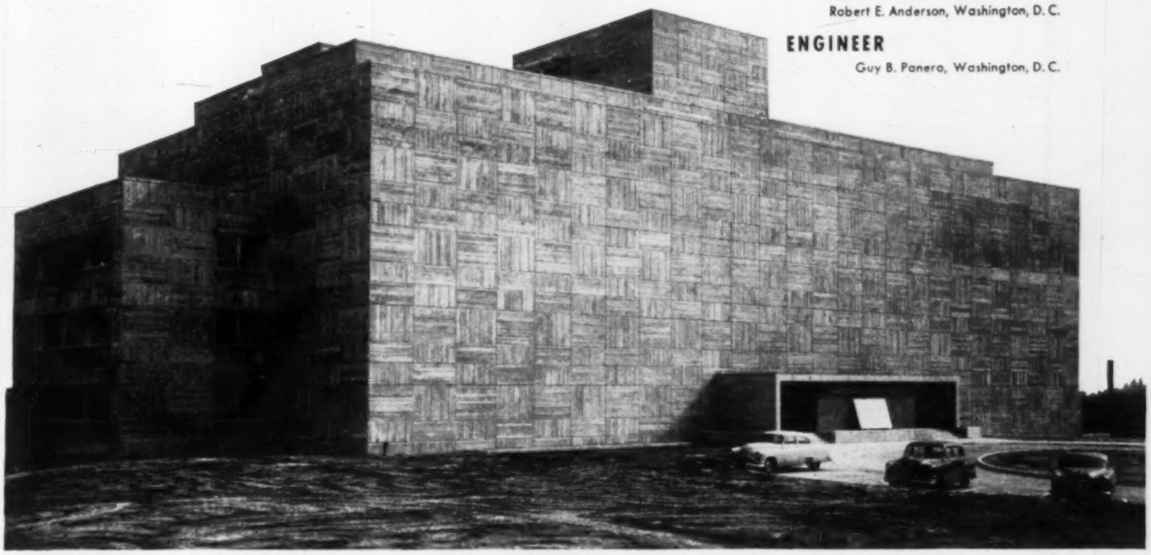
Centrifugal Pumps . . .

. . . engineered for quiet performance —Graymills Corp., 3705 N. Lincoln Ave., Chicago 13. In two series, "Thirty," shown, and "Thirty J.I.C.," with foot mounted motors. Feature provides 24 electrical outlet positions without disassembling pump.



Hammer Eliminator . . .

. . . for small commercial piping—Techniflex Corp., Port Jervis, N. Y. With ½ and ¾ in. male IPT connections. Design takes advantage of resiliency of seamless convoluted



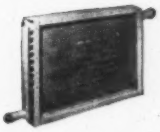
MECHANICAL CONTRACTOR
Robert E. Anderson, Washington, D. C.
ENGINEER
Guy B. Panero, Washington, D. C.

MARLO air conditions Washington's FIRST A-bomb resistant building

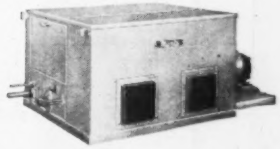
The new Armed Forces Institute of Pathology at Walter Reed Army Medical Center is the first building in the Washington, D. C., area expressly designed and built to withstand an atom-bomb explosion. The 21-inch thick walls of this huge block-type structure can resist pressures up to 27.2 pounds per square inch. Specially designed "blast" doors four and one-half inches thick guard all entrances. Inside, extraordinary precautions are taken against accidents from hazardous materials used in medical experiments.

This unique building is air conditioned with Marlo equipment, including eight Spray Type Dehumidifiers with Cooling Coils, four ceiling-type Air Handling Units, 45 floor-type Remote Air Handling Units, and 78 Heating Coils.

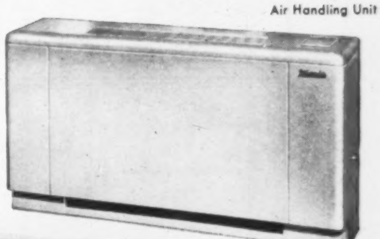
Whatever *your* air conditioning problem, you'll find the answer in the quality line of Marlo equipment. Write to Marlo today for complete information.



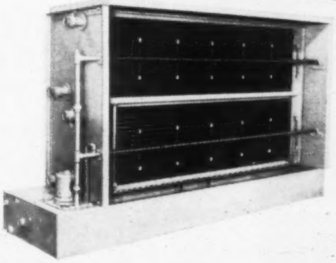
Heating Coil



Air Handling Unit



Remote
Air Handling Unit



Spray Type
Dehumidifier

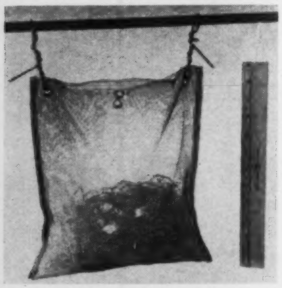
Marlo
COIL COMPANY

Manufacturers of COOLING TOWERS • EVAPORATIVE CONDENSERS • INDUSTRIAL COOLERS • AIR CONDITIONING UNITS • MULTI-ZONE UNITS • BLAST HEATING & COOLING COILS

Saint Louis 10, Missouri

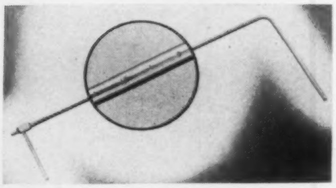
EQUIPMENT DEVELOPMENTS
Continued

metal hose combined with compressability of air pocket. Bronze braid covering has burst pressure of 900 psi minimum.



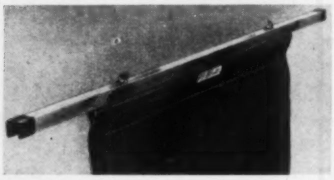
Phosphate Plates . . .

. . . for controlling scale, corrosion in recirculating cooling water systems—Calgon, Inc., 323 Fourth Ave., Pittsburgh 22. Is slowly soluble granulated phosphate placed in plastic mesh feeding bag hung in water spray inside cooling tower or evaporative condenser.



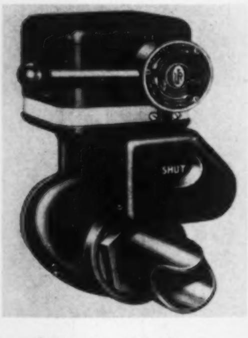
Pitot Tubes . . .

. . . stainless steel constructed with inch marks on both sides for easy reading—F. W. Dwyer Mfg. Co., P. O. Box 373, Michigan City, Ind. In 12 to 60 in. lengths. Designed for air velocity, static pressure measurement. With direct reading chart for air velocities, direct reading curves for temperatures to 800 F.



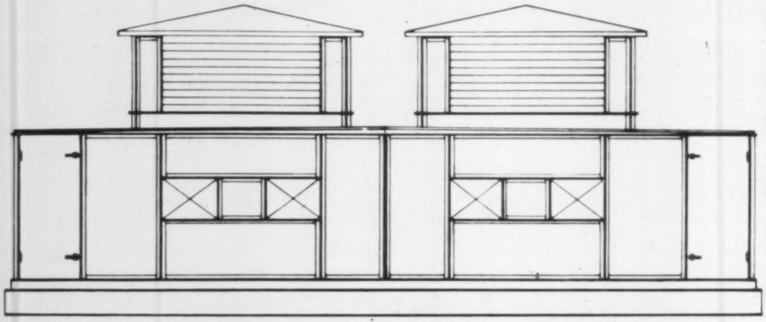
Holding Device . . .

. . . for building, engineering plans—Plan Hold Div. of Air Comfort Co., 5204 Chakemco St., South Gate, Calif. Designed to fit any existing plan rack, file. Holds without punching holes in prints by tightening wing nuts in holder.



Manual Reset Valves . . .

. . . for use with company's flame failure safeguard systems for gas, oil burners—Electronics Corp. of America, 720 Beacon St., Boston 15. Prevents reopening after failure unless holding coil is energized. In sizes 1 to 4 in. for manufactured, natural, mixed, LP gas; 1 to $1\frac{1}{4}$ in. for preheated No. 5 and No. 6 oil.



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INSULATED
TEST ASSEMBLED
MATCH MARKED
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COMPLETE
ACCESSIBILITY
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TYPICAL PENTHOUSE APPLICATION OF A & R INSULATED AND WEATHERPROOFED PANELS. READILY ADAPTABLE TO YOUR PRESENT AND FUTURE REQUIREMENTS.

(WRITE FOR CATALOG SECTION 50)

AIR & REFRIGERATION CORPORATION

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SALES REPRESENTATIVE IN PRINCIPAL CITIES

A&R

Another new development using

B. F. Goodrich Chemical *raw materials*

B. F. Goodrich Chemical Company does not make these panels. We supply only the raw materials.

Rigid vinyl windows beat double trouble

WHAT do you do when windows are attacked from two sides? By corrosive fumes and hot air inside, and outside by the weather. A chemical plant in Texas had the problem and found the answer. In went new translucent panels made from Geon rigid vinyl—out went the old windows and a costly maintenance problem!

Installing the green-tinted corrugated panels was easy—they were simply nailed in place. Because they are made from Geon, they resist sunlight, cold, rain, acids, alkalis, oil and grease. They are decorative as well as functional.

Products made from Geon rigid vinyl include corrosion-proof pipe, fume ducts, tanks, trays, materials that can be machined, planed, sawed, drilled, and cemented. You'll find other Geon polyvinyl materials in flexible, colorful upholstery, in high-dielectric insulation, in wear-resistant flooring, in hundreds of other successful products.

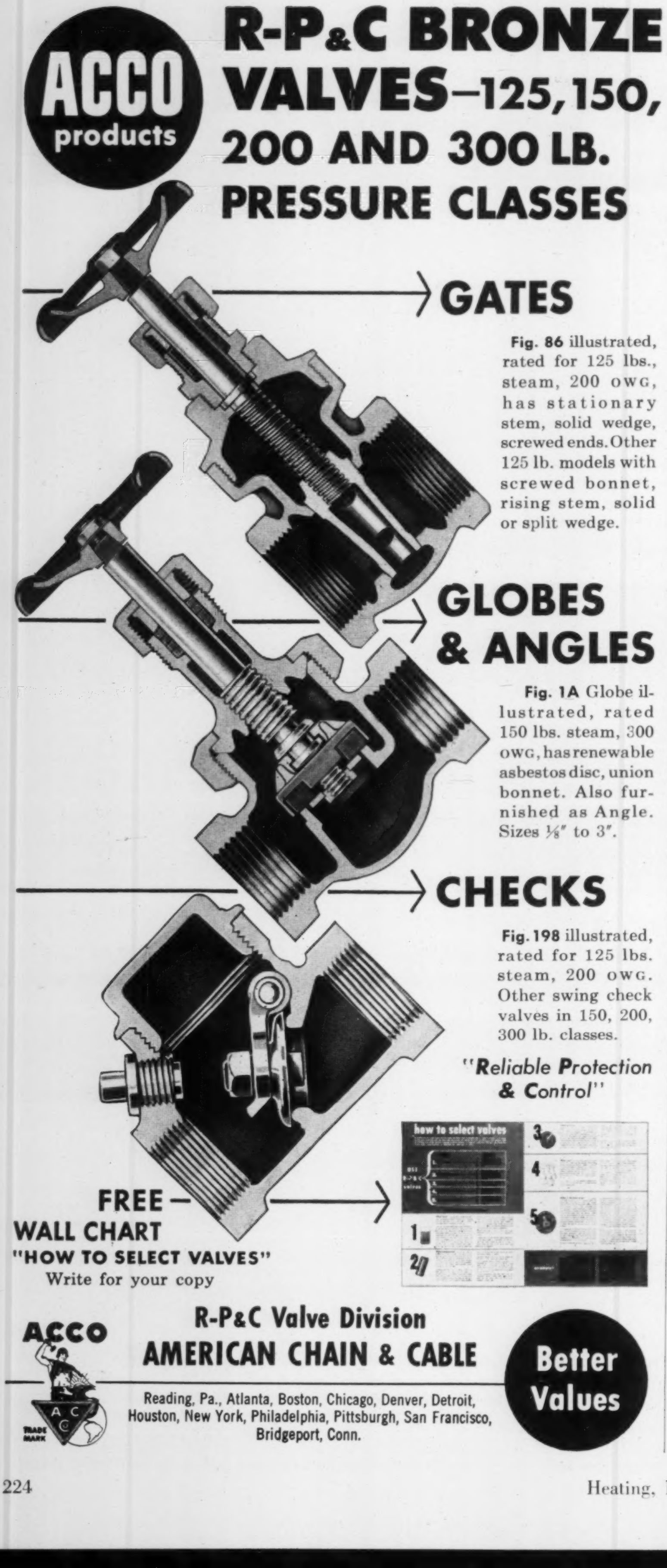
Geon's remarkable physical and chemical properties may give your products a decisive competitive edge.

For technical information, please write Dept. BN-3, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

Geon *Polyvinyl Materials*

GEON RESINS • GOOD-RITE PLASTICIZERS . . . the ideal team to make products easier, better and more saleable.

GEON polyvinyl materials • HYCAR American rubber and latex • GOOD-RITE chemicals and plasticizers • HARMON colors


ACCO products

R-P&C BRONZE VALVES—125, 150, 200 AND 300 LB. PRESSURE CLASSES

GATES

Fig. 86 illustrated, rated for 125 lbs., steam, 200 OWG, has stationary stem, solid wedge, screwed ends. Other 125 lb. models with screwed bonnet, rising stem, solid or split wedge.

GLOBES & ANGLES

Fig. 1A Globe illustrated, rated 150 lbs. steam, 300 OWG, has renewable asbestos disc, union bonnet. Also furnished as Angle. Sizes ⅛″ to 3″.

CHECKS

Fig. 198 illustrated, rated for 125 lbs. steam, 200 OWG. Other swing check valves in 150, 200, 300 lb. classes.

"Reliable Protection & Control"

FREE—
WALL CHART
"HOW TO SELECT VALVES"
Write for your copy

how to select valves

ACCO
R-P&C Valve Division
AMERICAN CHAIN & CABLE

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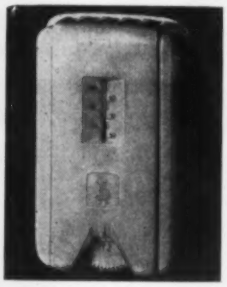
TRADE MARK

Better Values

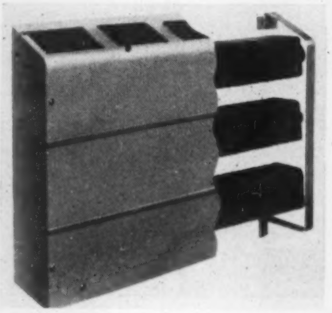
EQUIPMENT DEVELOPMENTS

Continued



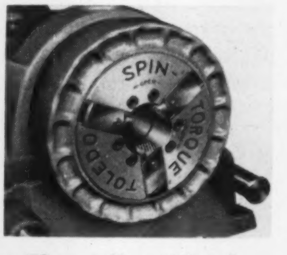
Thermostat . . .

. . . for control of heating, air conditioning equipment—Fulton Sylphon Div., Robertshaw-Fulton Controls Co., Box 400, Knoxville. Has differential of plus or minus ½ F deg, says company. Has high switch rating of 20 amp noninductive at 250 volts, ¾ hp motor load at 115 volts a-c, 1½ hp motor load at 230 volts a-c.



Enclosure . . .

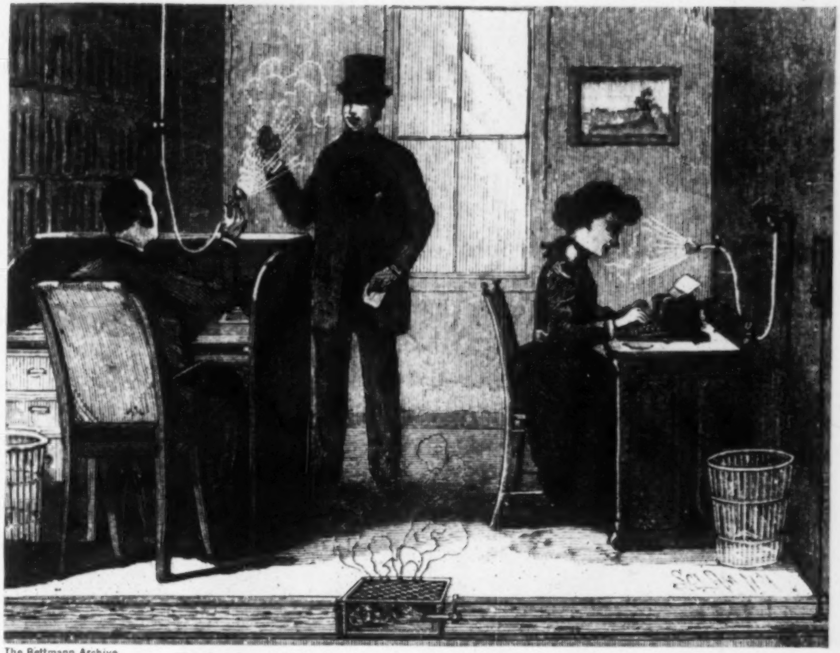
. . . for finned pipe radiation—Stedco Products, 71 Lehigh St., Wilkes-Barre, Pa. "Tuf-Top" designed for schools, auditoriums, buildings where rough use or abuse expected. For single, double, triple tier radiation, to accommodate 1¼ and 2 in. pipe size finned pipe radiation.



Pipe Threading Chuck . . .

. . . with special rocking wedge jaws which tighten as torque applied—

When your
clients
need
Air
Conditioning—


The Bettmann Archive

Here's air conditioning "custom-tailored" to an 1890 business office. Today Airtemp can give you specialized assistance to solve your clients' air conditioning needs.

AIRTEMP is "on call" to serve you!

AIRTEMP SOLVES SPECIALIZED PROBLEMS

Magnolia Building, Dallas, Texas. Air conditioned in 1938. Architects and Engineers: Lang & Weichel.

BIG BEAR MARKETS
Big Bear Supermarket, Detroit, Michigan. Engineers: Jentzen-Miller Co. Air conditioned in 1953. (All 26 Big Bear Supermarkets in Detroit area are air conditioned by Chrysler Airtemp!)

National Office Supply Company, Waukegan, Illinois. Air conditioned in 1954. Contractor: Stiles Brothers, Incorporated.

You get these extra helps in planning your commercial and industrial air conditioning

The System to Meet Your Need

Airtemp has a complete range of modern air conditioning equipment. Both conventional and specially-engineered types are precision-built, available for a room or a building.

Individual Engineering Guidance

We offer special engineering assistance. This service is available through Airtemp Construction Corporation, subsidiary of Chrysler Corporation—pioneer in commercial and industrial air conditioning.

Chrysler Leadership

You can specify with confidence. Your clients trust Chrysler's high engineering standards.

Continuing Local Service

Airtemp's nationwide network of personnel and facilities will serve your clients' needs through the years.

Low Cost Due to Peak Efficiency

Both installation and operating costs are low, resulting from Airtemp's high standards of efficiency and economy.

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Comfort Zone

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DIVISION OF CHRYSLER

AIR CONDITIONING AND HEATING FOR HOMES, BUSINESS, INDUSTRY

KENNEDY

gives you the answers to your Valve questions . . .

KENNEDY
Bronze Valve Check Chart
How to select the right valve for your specific job!
Gate Valves
Globe, Angle Valves
Check Valves
Seats and Discs
Bonnets
Stems
THE KENNEDY VALVE MFG. CO., ELMIRA, N. Y.
VALVES
PIPE FITTINGS
FIRE HYDRANTS

with the New KENNEDY VALVE Check Charts . . .

show you at a glance *How, When, Where* to use the correct valve to fit the job!

Now you can tell at a glance the correct KENNEDY Valve to use on a specific job . . . and why! These new valve Check-Charts show you the important features of the various types of KENNEDY Valves and explain their proper installation and use. Show you which valves go where . . . list specific Figure Numbers for accurate selection . . . describe why that valve should be used . . . and even suggest additional uses for Kennedy Valves.

One chart describes Kennedy Bronze Valves and its companion chart lists uses and conditions for Iron-Body Valves.

Designed for fast, easy reference, contains the answers to most of your valve questions. Large enough (16½" wide x 25" deep) for easy reading and hangs right on your wall in your office or shop.

Here are long-needed valve Check-Charts that give you quick, correct information and show you how and why certain valves are built for specific jobs. Get your Kennedy Valve Check-Charts today!

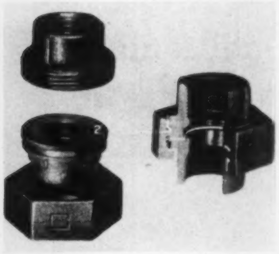
• GET YOUR KENNEDY VALVE Check Charts NOW! . . . ask your nearest KENNEDY Distributor or WRITE direct.

THE KENNEDY VALVE MFG. CO.
1021 E. WATER ST. ELMIRA, NEW YORK
• VALVES • PIPE FITTINGS • FIRE HYDRANTS
OFFICE-WAREHOUSES IN NEW YORK, CHICAGO, SAN FRANCISCO • SALES REPRESENTATIVES IN PRINCIPAL CITIES

EQUIPMENT DEVELOPMENTS

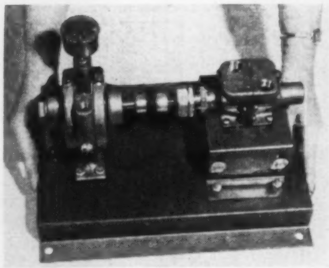
Continued

Toledo Pipe Threading Machine Co., 1445 Summit St., Toledo 4. Jaws close quickly, smoothly with spin of hand wheel, says company. Diagonal serrations on jaws designed to eliminate end thrust slippage, permit clockwise or counter clockwise rotation. Clamps rod or bolt stock ¼ in. up, pipe or conduit ⅛ to 2 in.



Insulating Union . . .

. . . for gas service—Grabler Mfg. Co., 6565 Broadway, Cleveland 5. Designed to reduce electrolytic corrosion. Insulates one supply line pipe from another. Rated at dielectric strength of 250 volts. For 300 psi with cold water, 150 psi with steam. Dielectric sleeve and rubber gasket separates "swivel" of union from body and nut to prevent electric contact.



Explosionproof Pump . . .

. . . designed for corrosive, hazardous materials—Eco Engineering Co., 12 New York Ave., Newark 1. Driven by manually adjustable air motor with 40 to 100 psig compressed air pressure range. Available with reversible air motors. Pump is positive displacement type with chemically inert mechanical seal. Handles nonabrasive fluids to 10 gpm.

Two large Fitzgibbons "D" Type Firebox Steel Boilers installed in Bloomingdale's, Stamford, Conn., one of the nation's newest suburban Department Stores.

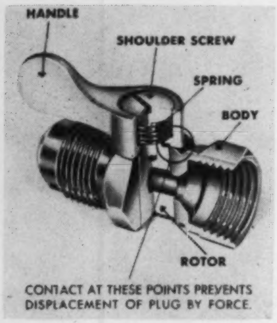
Sentinels of comfort... and comfort's cost!

FITZGIBBONS STEEL BOILERS give big building heating systems that extra insurance factor that means dependable heat and comfort at all times. Functioning as the heart of the system, these carefully engineered and ruggedly built boilers respond quickly and operate with superior fuel-saving efficiency. From any standpoint – ease of installation, fuel saving, convenient servicing–you just can't beat a Fitzgibbons. Make sure it figures in your next job.

ARCHITECTS, ENGINEERS – The wide experience of local Fitzgibbons engineering representatives is always available for boiler sizing and other heating suggestions. Representatives are located in principal cities. For information on the nearest one, write Fitzgibbons Boiler Company, Inc., 101 Park Avenue, New York 17, N. Y.

The Fitzgibbons Boiler®

EQUIPMENT DEVELOPMENTS
Continued

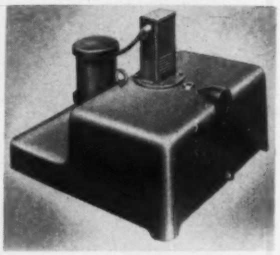

HANDLE
SHOULDER SCREW
SPRING
BODY
ROTOR
CONTACT AT THESE POINTS PREVENTS DISPLACEMENT OF PLUG BY FORCE

Gas Valve . . .

. . .designed with combined safety features of fixed adjustment lock nut types, spring loaded plug types—Gas Valve Div., Deutsch Co., 7000 Avalon Blvd., Los Angeles. Has spring takeup for wear, displacement of lubricant. Spring contained within head of plug.

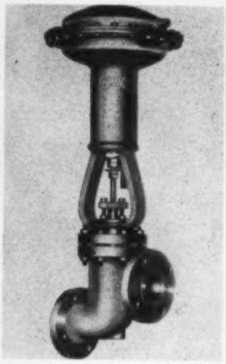
Condensation Units . . .

. . .for school, office, apartment heating systems—American Marsh Pumps, Inc., 60 Capital Ave., N.E., Battle Creek, Mich. "Redi-Return" has floatless electrode controls with corrosion resistant stainless steel rods, tips to operate pump through water contact. With "lifetime-lubricated" motor, balanced bronze impeller, mechanical seals. In sizes to handle from less than 5000 sq ft EDR at 20 lb discharge pressure, to 18,000 sq ft at 20 lb, 9000 sq ft at 30 lb, etc.



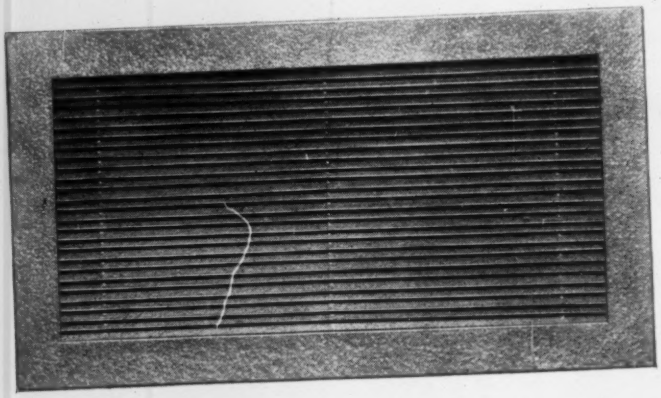
Valve . . .

. . .with features of special valves used on dangerous applications—Hammel Dahl Co., 175 Post Rd., Providence 5. In offset (shown), angle, in-line body styles. Cited features: internal parts removable through bonnet; parts for three body types interchangeable; Teflon seal requires no lubrication, adjustment; self draining design eliminates need for frequent cleaning. In sizes ½ to 6 in.



Cooling Units . . .

. . .with 8, 10, 15 ton capacities—Janitrol Heating & Air Conditioning Div., Surface Combustion Corp., Toledo. Self contained in console type cabinets. To operate, only condenser water, drain and electrical connec-



- CUTS INSTALLATION TIME OVER ½!
- EASY TO INSTALL *Anyone Can Do It!*
- COMPLETE—NO WOOD MOLDINGS TO ADD!

NEW! **THIN CORE GRILLE FOR DOORS – PARTITIONS ¼" to ¾" THICK!**

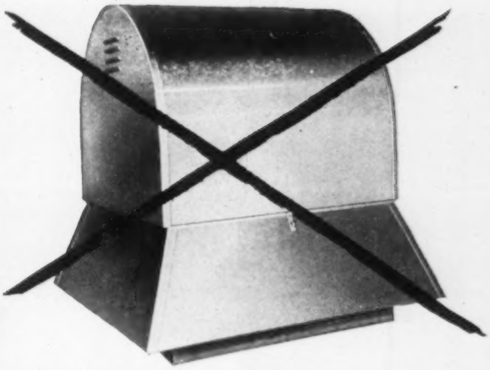
First Grille ever designed specifically for thin doors and partitions. Anyone can install it in just a few minutes time. No close tolerances required . . . almost a half-inch extra on sides for positioning. Telescoping auxiliary frame fastens to grille with posts and screws. Clamps tight. No holes to position. Practically no danger of ruining door. No wood moldings. All steel. Rattle-proof. No vision, with 80% free area. Available with or without frame, all sizes. Gray or tan prime coated, or Hammertone finish in gray or bronze.

→ **ACTUAL SIZE Cross Section**

WRITE FOR OUR COMPLETE
FREE CATALOG
Listing Over 1000 Types and Sizes of Grilles for Every Requirement

A-J MANUFACTURING CO.
Dept. H-7 - 2119 Washington St. - Kansas City, Mo.

NEWS!



NOW YOU CAN CROSS UNSIGHTLY PENTHOUSE TYPE ROOF VENTILATORS OFF YOUR LIST!

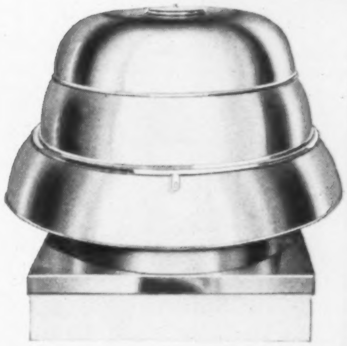
WITH THESE

MODERN CARNES MODELS

MODEL CL

This streamlined, low silhouette model is precision-built for smooth, quiet, efficient operation. Plus these outstanding features . . . wide capacity ranges; all-aluminum construction; heavy duty, ball-bearing, protected motors; all models with backwardly inclined, non-overloading centrifugal fan wheels.

MODEL J



Also designed for today's low parapet buildings, with all-aluminum spun housings to eliminate corrosion and maintenance problems. Features include . . . centrifugal fan wheels statically and dynamically balanced; heavy duty precision pillow block and drive; specially designed vibration isolators. In fan wheel sizes from 24" to 48".

At Carnes, a specially designed building houses complete facilities for expert engineering and thorough testing under actual operating conditions . . . your assurance of the finest quality in every product that bears the Carnes name.

WRITE FOR

FREE BOOK

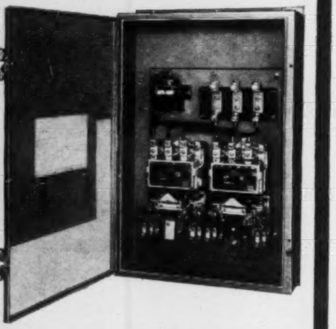
A complete story on Carnes facilities, products and performance data. It's yours for the asking.

FACTS YOU SHOULD KNOW ABOUT
CARNES
CEILING DIFFUSERS AND POWER ROOF VENTILATORS

CARNES CORP.

VERONA, WISCONSIN

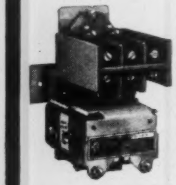
FURNAS ELECTRIC CONTROLS do the best job for AIR CONDITIONING



Objectionable voltage drops eliminated by using a Furnas Electric Increment Starter for Part Winding motor applications. Compare—no expensive auto transformers, no resistors, small size. Increment starting incorporates the advantages of other types of step starting at the lowest cost in the smallest space. Pick the size you need. In-between sizes—a 10, 20*, 30, 40* and 60 hp. size 220 volts.

*Major savings with in-between sizes.

SPECIAL STARTERS AND CONTACTORS



Designed for low cost control of hermetic motors. Two sizes — 20 and 30 amps • Dual voltage starter coils • Interchangeable parts • Super Quick Trip Thermal Overload units.

Write for Bulletin #5410 for complete air conditioning control information. Furnas Electric Company, 1041 McKee Street, Batavia, Illinois.

FURNAS ELECTRIC COMPANY

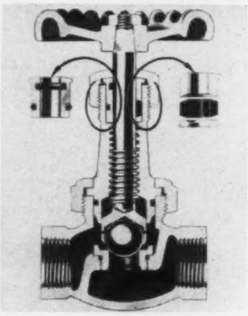
BATAVIA ILLINOIS

Sales Representatives in all Principal Cities

EQUIPMENT DEVELOPMENTS

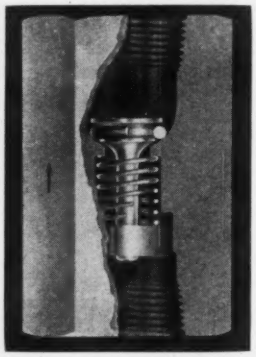
Continued

tions required, says company. Twin refrigeration circuits are feature of 10 and 15 ton models for two stage operation.



Ball Valve . . .

. . . carries four "O" rings as seals—Carpenter Valves Corp., 6723 Denison Ave., Cleveland 2. Rings seal stem, stuffing box, bonnet, under seat. Optional packings available for different services.



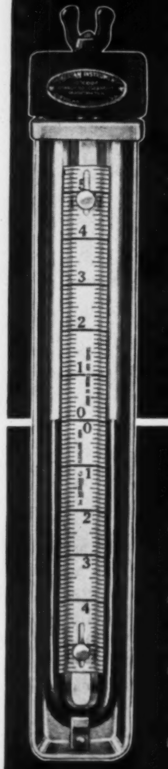
Check Valve . . .

. . . for service to 10,000 psi—James-Pond-Clark, 2181 E. Foothill Blvd., Pasadena 8, Calif. Floating poppet

UNMATCHED ACCURACY

with simplicity and economy

AT LOWEST COST . . . this Meriam Manometer offers high accuracy. The Meriam B-1103 is the easy-to-use, always dependable form of pressure or flow instrumentation. Pressures to small fractions of an ounce are read directly, accurately . . . without calibration or instrument adjustment . . . with complete enduring manometer reliability.



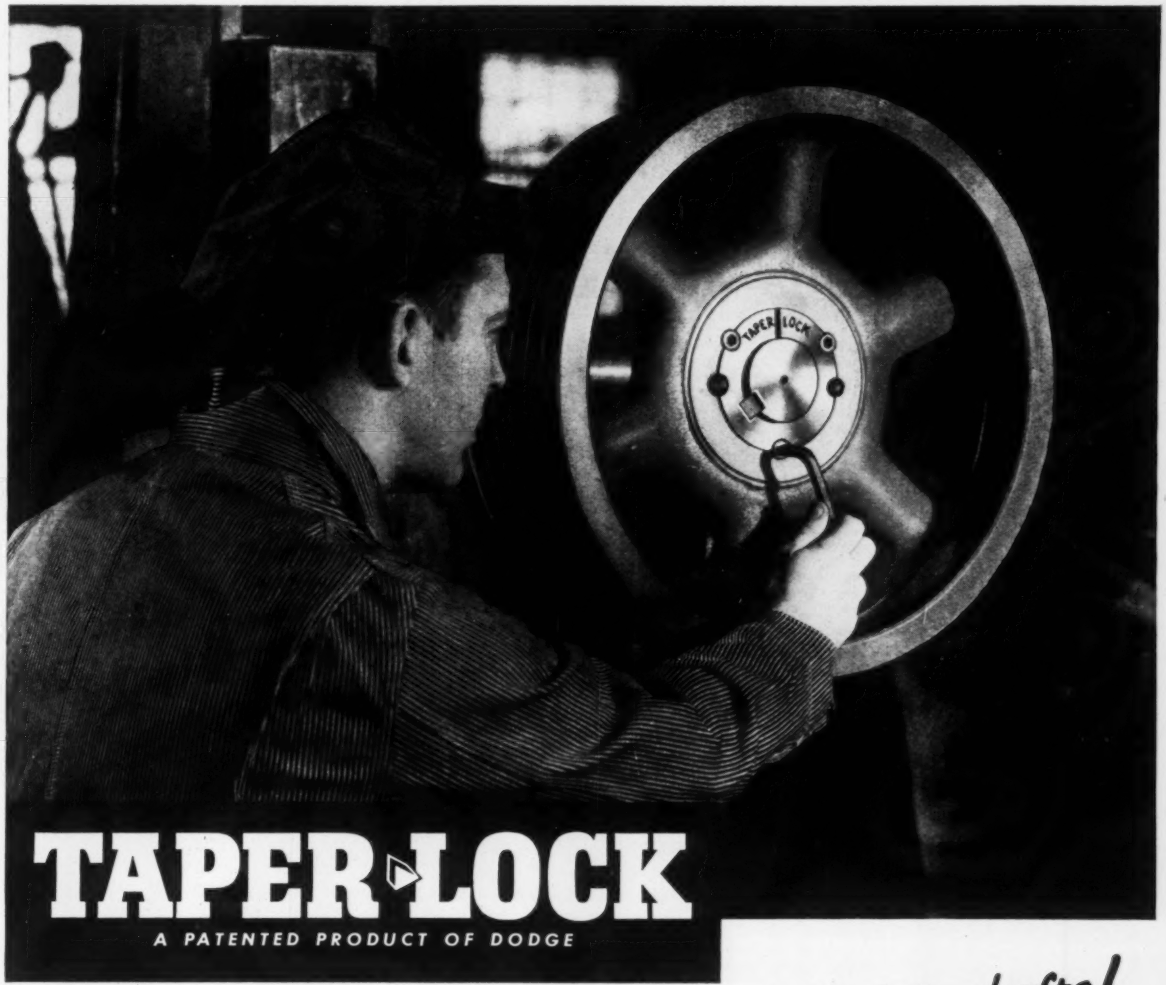
- ★ Rugged cast alloy construction
- ★ Convenient manometer cleanout
- ★ Curved scale for increased readability
- ★ Designed for easy panel mounting

Write for Bulletin C-12.

Meriam Manometer Instrumentation ...for pressures, vacuums, flows, liquid levels.

meriam INSTRUMENT COMPANY

10920 Madison Ave. • Cleveland 2, Ohio



TAPER-LOCK

A PATENTED PRODUCT OF DODGE

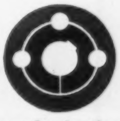
The simplest, surest means of mounting wheels to shafts!

Slip it on the shaft, line it up and tighten while sighting! Mount sheaves, sprockets, couplings, conveyor pulleys *quicker*—and more easily—with Taper-Lock bushings. A few twists of a hex wrench and Taper-Lock grips the shaft with the firmness of a shrunk-on fit. It comes off as easily, without shock to bearings or machinery. Bushing seats evenly along entire length of the hub—*wheels run true!*

Standardize on Taper-Lock. You save time and money and keep production rolling with these *interchangeable* bushings. See your Dodge Distributor, or write us for the full Taper-Lock story.

CALL THE TRANSMISSIONEER, your local Dodge Distributor. Factory trained by Dodge, he can give you valuable assistance on new, cost-saving methods. Look for his name under "Power Transmission Machinery" in your classified telephone directory, or write us.

THERE'S ONLY ONE TAPER-LOCK, THE BUSHING THAT MOUNTS FLUSH!



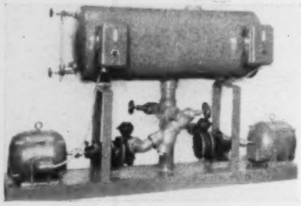
Standardize, economize with Taper-Lock, the bushing that is interchangeable in Dodge sheaves, sprockets, couplings and conveyor pulleys. *More than 2,000,000 in use!*

DODGE

of Mishawaka, Ind.

DODGE MANUFACTURING CORPORATION, 1600 UNION STREET, MISHAWAKA, INDIANA

EAGAN Boiler Feed Pump Assemblies
Are
PRE-Packaged to prevent POST-Delivery Troubles



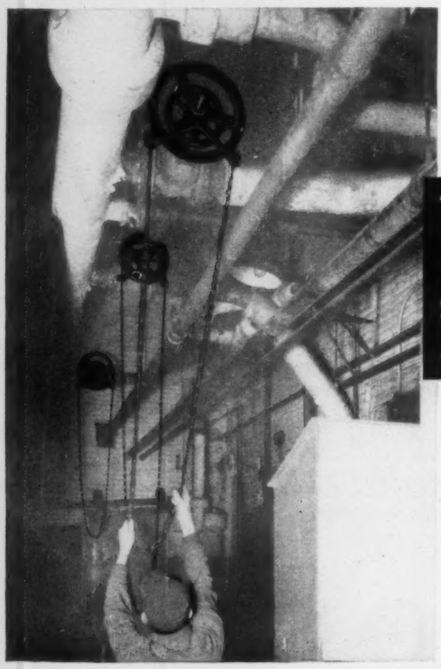
They combine the function of
boiler feeding
and
fresh water make up

EAGAN Boiler Feed Pump Assemblies are designed to provide a dual service — boiler feeding and fresh water make up. They handle capacities up to 100,000 sq. ft. at 200 psi. . . are made in single and duplex models. On this pump, the receiver is located in a raised position. The advantage? To prevent flashing when traps leak.
Check on all the features and advantages of EAGAN Pre-Packaged Boiler Feed Pumps — pumps that perform right. . . right from the start. Ask about EAGAN . . . today.

WALTER H. EAGAN CO., INC.

Mfrs. of condensate, vacuum, turbine, boiler feed, centrifugal, and proportioning pumps and fuel oil pump and heater sets.

Pump Specialists Since 1920
2337 Wallace Street, Philadelphia 30, Pa.



Every Valve
Easily Accessible
with

Babbitt
—Adjustable—
SPROCKET RIM
with Chain Guide

NEWLY REDESIGNED for greater strength—easier, quicker, more solid assembly.

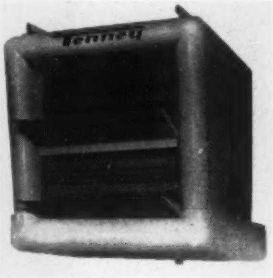
- **Simplifies pipe layouts**
- **Fits any size valve wheel**
- **Prevents accidents**

Your supplier carries complete stocks. Call him — or write for details and prices.

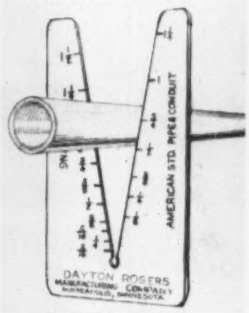
Babbitt STEAM SPECIALTY CO.

8 BABBITT SQUARE, NEW BEDFORD, MASSACHUSETTS, U. S. A.

designed to be not affected by foreign particles in fluid. Requires no "wire drawing" across seat. Engineered for high pressure hydraulic, pneumatic applications.



Unit Cooler . . .
. . .featuring easy installation—Tenney Engineering, Inc., 1090 Springfield Rd., Union, N.J. One man hangs template mount, slides unit into place on rail hangers, connects refrigerant and power and drain lines, says company. Models range 4000 to 40,000 Btu capacity.



Pipe, Conduit Gage . . .
. . .offered for free distribution—Dayton Rogers Mfg. Co., 2824 13th Ave., S., Minneapolis 7. Will calibrate standard iron pipe 1/8 to 1¼ in. Has scale in sixteenths for all kinds, makes of tubing.

Thermostatic Expansion . . .
. . .valves for industrial, commercial refrigeration, air conditioning equipment—General Controls Co., 801 Allen Ave., Glendale 1, Calif. Feature high sensitivity and flange type tongue and groove connectors. In

GREAT NEWS
from Modine

TYPE F—Shown here, is a deluxe floor convector with curved outlet grill and visible damper.

The latest in convector styling—designed for every application

Now public, commercial and institutional buildings—old or new—can be equipped with beautifully styled, efficient, quality-built Modine Convectors. There's a model to meet every requirement—30 types, 8000 sizes.

And each model . . . regardless of its price bracket . . . is craftsman-built in every detail . . . the reason why Modine has been a leader in convector design and fabrication for more than a quarter of a century.

Before you specify or buy convectors, be sure you have the Modine story. See the Modine representative listed in your classified phone book or write for Catalog 255—Modine Mfg. Co., 1509 DeKoven Ave., Racine, Wis.

30 types 8000 sizes

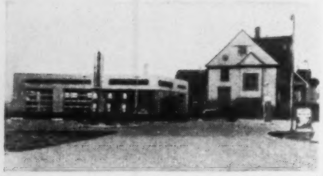
There's a Modine Convector to meet your exact needs: Deluxe, standard and institutional models—free-standing, fully and partially recessed, concealed and wall-hung types with many design variations.

Modine

CONVECTOR RADIATION

R-1273

HERE'S PROOF!



August, 1940—Shafconaire Model No. 200, 150,000 BTU output, installed in this Shell Station, corner of Maple and Hunter Blvd., Birmingham, Mich. It gave outstanding service, minimum downtime—until station was finally remodeled.

October, 1954—
Same location . . . new larger station . . . and again, they specified and installed a . . .

SHAFCONAIRE®

Yes, 14 years of continuous, trouble-free service is the record SHAFCONAIRE rolled up in this installation. Small wonder that SHAFCONAIRE . . . the original OverHead Heater . . . is ordered . . . and re-ordered . . . and re-ordered!

Large and small companies in virtually every industry have come to depend on SHAFCONAIRE. Available in 100,000 to 405,000 BTU output, this rugged overhead furnace utilizes either oil or gas . . . and there's a size for every installation need.

Write today for free brochure on how OverHead Heaters can help you solve your heating problems!

Up in the Air and out of the Way!
SHAFCONAIRE
OVERHEAD HEATERS

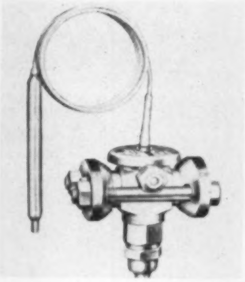
OverHead Heaters, Inc.
1612 BOOK BUILDING • DETROIT 26, MICH. • WOODWARD 2-4647

OverHead Heaters, Inc.
1612 BOOK BUILDING, DETROIT 26, MICHIGAN

Yes, gentlemen, send me your free brochure on how OverHead Heaters can solve my heating problems.

Name............................ Title...................
Company ....
Address ....
City............................ Zone...... State..........

EQUIPMENT DEVELOPMENTS
Continued



$\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$ in. inlet tube sizes; $\frac{5}{8}$, $\frac{7}{8}$, $1\frac{1}{8}$ in. outlet tube sizes. Capacity range to 10.5 tons.

Equipment Briefs . . .

FLOW DIAGRAMS designed to increase operating convenience of water treatment equipment—Graver Water Conditioning Co., 216 W. 14th St., New York 11. Made of specially laminated plastic. Are made to order to individual needs.

VACUUM CLEANER for boilers, furnaces—Pullman Vacuum Cleaner Corp., 33 Allerton St., Boston 19. Has new secondary filter designed not to clog. Complete attachments available with kit.

SEPARATE MOTOR DRIVE new variation of company's "Speed-Trol" variable speed transmission — Sterling Electric Motors, Inc., 5401 Telegraph Rd., Los Angeles 22. Coupled with any foot mounted motor by flexible coupling, mounting shelf.

FOG NOZZLES for fire protection, other industrial uses—Bete Fog Nozzle, Inc., Greenfield, Mass. Have two spiral turns, producing inner, outer cone. With $\frac{1}{2}$ in. male pipe threads. Flow rates 5 to 50 gpm.

NYLON JACKET designed to eliminate streaking from ceiling cable installation—Modernheat Cable Corp., Box 576, Kingsport, Tenn. Cable is said to have increased strength, durability.

On duct-insulation jobs—

Low installation cost of Microlite and L·O·F Super·Fine can clinch the contract

Speed and ease of application can mean the difference in cost it takes to clinch a big insulation contract. That's why many contractors use L·O·F Glass Fibers' Super·Fine and Microlite to cut application costs without sacrificing insulating efficiency.

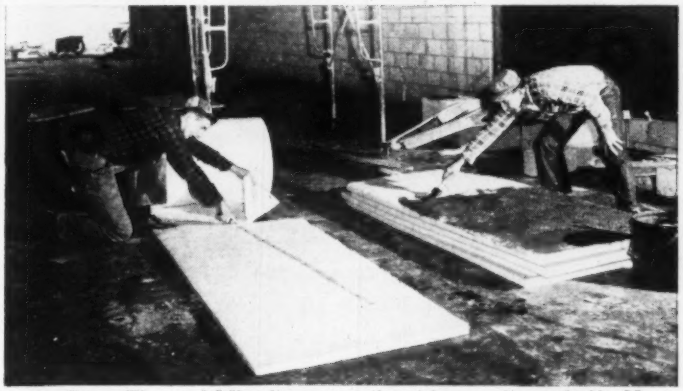
You'll find it simple to apply—These soft-textured blankets are pleasant to handle, quick to apply. Require no special tools or skills. Lightweight, resilient L·O·F Super·Fine and Microlite fill hard-to-reach places and are easy to manage on tall ladders or scaffolds. An unskilled worker can apply an average of 500 square feet of insulation a day.

The high insulating efficiency of Microlite and L·O·F Super·Fine results from the countless dead air cells formed by millions of fine glass fibers, which effectively reduce heat loss or gain.

Save on storage space, too—L·O·F Super·Fine and Microlite come in tightly compressed rolls that take up less space and spring back to full thickness when unrolled. Available in blanket form up to 72″ wide, 5″ thick and from 50′ to 200′ long, depending on thickness. Also available with various facings to meet different insulation and code requirements.

Save on duct application costs with Microlite or L·O·F Super·Fine duct wrap and duct liner. Look in the Yellow Pages of the telephone directory for the name of our nearest distributor, or write: L·O·F Glass Fibers Company, Dept. 39-75, 1810 Madison Avenue, Toledo 1, Ohio.

Time- and cost-saving steps in a typical duct application



1. Super·Fine and Microlite cut easily with an ordinary knife. No precision measuring or fitting required. In this case, adhesive is brushed on the insulation.

2. Lightweight, strong blankets of Microlite or Super·Fine handle easily on scaffolds or ladders.

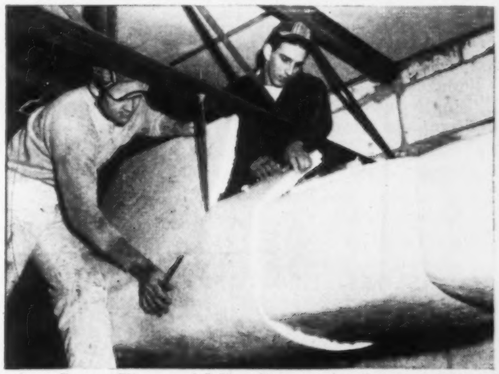
MICROLITE

L O F GLASS FIBERS

SUPER·FINE

L·O·F GLASS FIBERS COMPANY
TOLEDO 1, OHIO

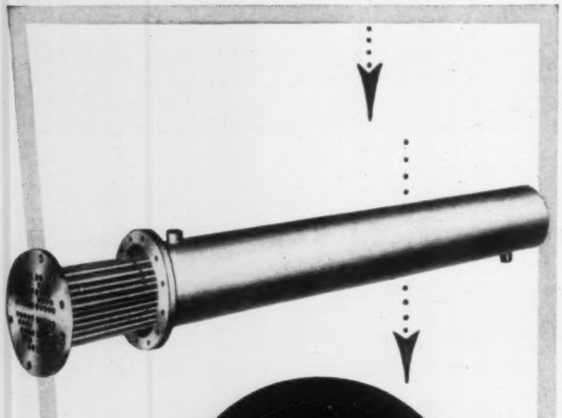
Makers of glass fibers by the exclusive "Electronic-Extrusion" process



3. Super·Fine and Microlite can be fitted quickly around the duct and supporting hangers. Light-gauge wire ties complete the job.

easy solution to

tough specifications



TACO
Heat Exchanger

Whatever your requirements — simple or complex — Taco can supply you immediately with the right heat exchanger! TACO know-how will help you select the heat exchanger you can depend upon to do the job right!

Engineered for top performance, minimum maintenance, and built to exacting standards through quality controlled manufacturing. Call or write for complete information.

Condensate Coolers • Converters • Chillers • Circulating Pumps
Fuel Oil Heaters • Oil Coolers
Radiation Heaters • Tank Heating Units • Water Heaters

TACO HEATERS, INCORPORATED
1160 Cranston Street
Cranston 9, R. I.

Taco

EQUIPMENT DEVELOPMENTS

Continued

INSPECTION TOOL designed for radiographing steel to 7 in. thick—Babcock & Wilcox Co., 161 E. 42nd St., New York 17. Called "Isoscope", unit requires only one-third exposure time of million volt x ray unit, says company. Is radioactive Cobalt 60 loaded into spherical lead container encased in steel jacket.

EVAPORATIVE AIR COOLERS added to manufacturer's line—Pioneer Furnace Co., 3131 San Fernando Rd., Los Angeles. Includes portable blower type models. One portable model has 600 cfm output, yet weighs only 30 lb, says company.

AIR CONDITIONING TIMER for use as integral part of unit—Small Appliance Div., General Electric Co., Ashland, Mass. Designed to be fully automatic. With two day skip feature that turns unit off for weekend, on for return.

CEMENT LINING for water storage heaters, steel tanks—Pocono Fabricators, Inc., Div. of The Patterson-Kelley Co., Inc., East Stroudsburg, Pa. Formulated to prevent rust, is said not to shrink or crack.

EXTENSION LUBRICATOR for injecting lubricant as packing in pump shaft stuffing boxes—Meter and Valve Div., Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8. Previously made to customer request, now stock item.

HOSE CLAMP designed for fast installation, removal—Aero-Seal Hose Clamps, 700 Liberty Ave., Union, N. J. Is attached by pushing housing to snug fitting position on clamp band, tightening worm screw. Clamp has stainless steel construction.

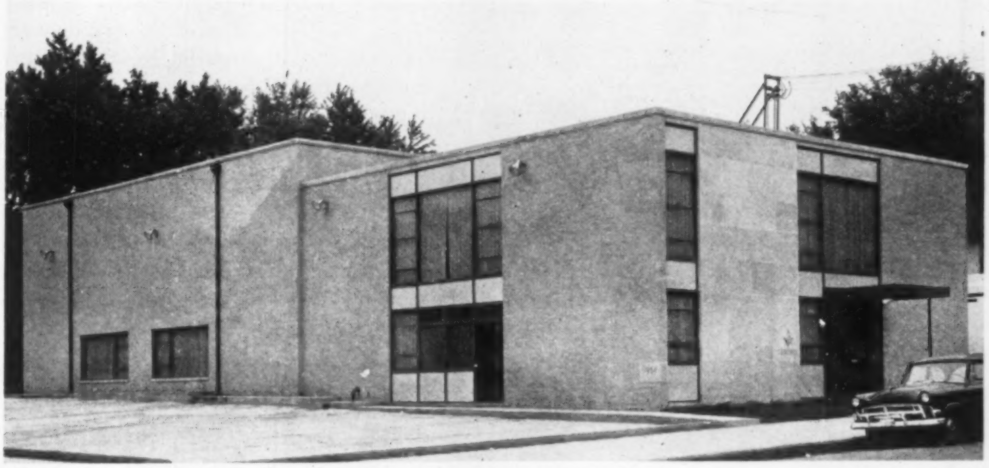
INSULATION KIT designed to protect pipes from freezing, dripping—Smith-Gates Corp., Plainville, Conn. Consists of 25 ft of 3 in. wide glass fiber, two rolls 20 ft of 1½ in. wide waterproof tape. Applied by spiraling blanket around pipe, wrapping with tape.

WORM GEAR REDUCER for long, unsupported vertical output shaft extensions—Philadelphia Gear Works, Erie Ave. and G St., Philadelphia 34. Cited applications: circulators, pumps, washers, other vertical type drives. Has wide bearing span for rigidity. "Dry well" construction requires no stuffing box.

BLOWER WHEELS with corrosion-resistance for air conditioners, cooling towers, evaporative condensers—Morrison Products, Inc., E. 168th St. and Waterloo Rd., Cleveland 10. In seven diameters 10 to 20 in., nine widths 6 to 20 in.

WARM AIR HEATED...

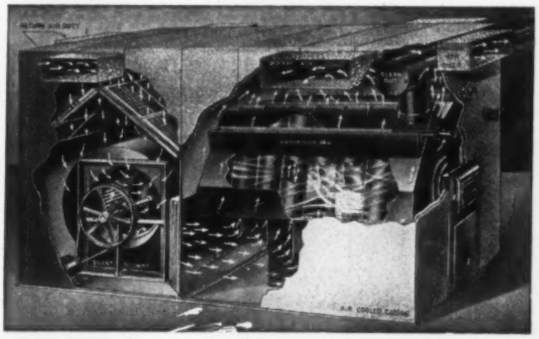
by Campbell



Auburn Masonic Lodge No. 592, Des Moines, Iowa, heated with a Campbell 8000 Series Gas Fired Unit. Installed in 1954 by Backman Sheet Metal Works, Des Moines. Architect, Ken Haynes, Des Moines.

LOW COST HEATING

It's easy, practical, economical to use warm air heating in large multi-room buildings when you use Campbell No. 8000 Heaters. The exceptional efficiency of the units assures outstanding fuel economy. Cost of the heating unit and installation are both surprisingly low; especially when the heating system is installed in conjunction with summer air conditioning. Give Campbell Warm Air Heating Engineers an opportunity to figure on your next large heating job.



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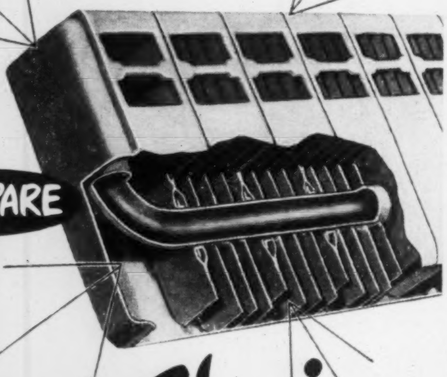

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- balanced combination of radiant-convected heat
- 3"—space saving design
- high heating efficiency
- lifetime beauty—no upkeep
- right or lefthand supply tapping
- factory assembled—one piece units
- fast, easy installation

Regardless of heat-source . . . steam or hot water . . . Shaw provides a perfect ratio of radiant-convected heat. Schools, Hospitals, Institutions, Office Buildings, Industry and the Home have long demanded a more compact and efficient radiator combining ruggedness of construction with beauty and efficiency.

There is a Shaw radiator available for every heating application. The Shaw Panel Baseboard with the long, low, thin look for modern baseboard heating. The Shaw Panel Radiator for under windows or areas requiring utmost efficiency and with small available space. The Perkins Industrial Radiator for the factory, warehouse, and where uniform, constant heat is desired and is not obtained with the on and off type blast heating common with unit heaters.

SP-3

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MANUFACTURING CO.
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RECENT TRADE LITERATURE...

▶ *ABRASIVE CUTTING MACHINES*—Featuring bench type, floor type models of abrasive cutting machines, 4 page bulletin includes data on length of cutting time for various shapes, types of materials. Beaver Pipe Tools, Inc., Warren, Ohio.

▶ *ADHESIVES, COATINGS*—New bulletins describe adhesives, coatings for use with insulation and for refrigeration and air conditioning industry. Both publications contain charts for selection. Minnesota Mining and Mfg. Co., Adhesives and Coatings Div., 411 Piquette Ave., Detroit 2.

▶ *AIR CLEANING EQUIPMENT*—Illustrated data sheet states problem of air pollution, describes washers, degasifiers, precipitators constructed of redwood to combat it. California Redwood Assn., 576 Sacramento St., San Francisco 11.

▶ *AIR CONDITIONERS*—New 4 page bulletin describes line of "Mil-ac" air conditioners, mobile units designed primarily for military trailers. Are said to operate under extreme climatic conditions. Ellis & Watts Products, Inc., P.O. Box 33, Cincinnati 36.

▶ *AIR CONDITIONING*—Multizone units for simultaneous air conditioning of separate rooms at desired temperatures covered in 12 page catalog. Contains specifications, selection and ordering information. Bush Mfg. Co., West Hartford, Conn.

▶ *AIR CONDITIONING PUMPS*—Bulletin covers close coupled centrifugal air conditioning pumps in fractional horsepower units with capacities to 150 gpm, heads to 140 ft; integral horsepower units to 400 gpm, 165 ft. Allis-Chalmers Mfg. Co., 1171 S. 70th St., Milwaukee.

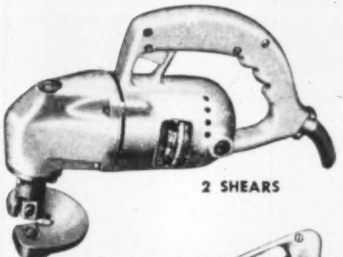
▶ *AIR DISTRIBUTION SYSTEMS*—New manual on multivent, low velocity air distribution systems is flexible covered ring binder covering basic principles, installation data for all types of ceilings. Pyle-National Co., 1373 N. Kostner Ave., Chicago 51.

▶ *ASH GATE FEED HOUSING*—Ash gate feed housing unit for flooded type hoppers covered in new data sheet GGa. Four page bulletin illustrates essential components. Allen-Sherman-Hoff Co., 259 E. Lancaster Ave., Wynnewood, Pa.

▶ *AUTOMATIC CONTROL SYSTEMS*—How company can assist in choosing right control system, de-

31 DRILLS

21 SCREW DRIVERS



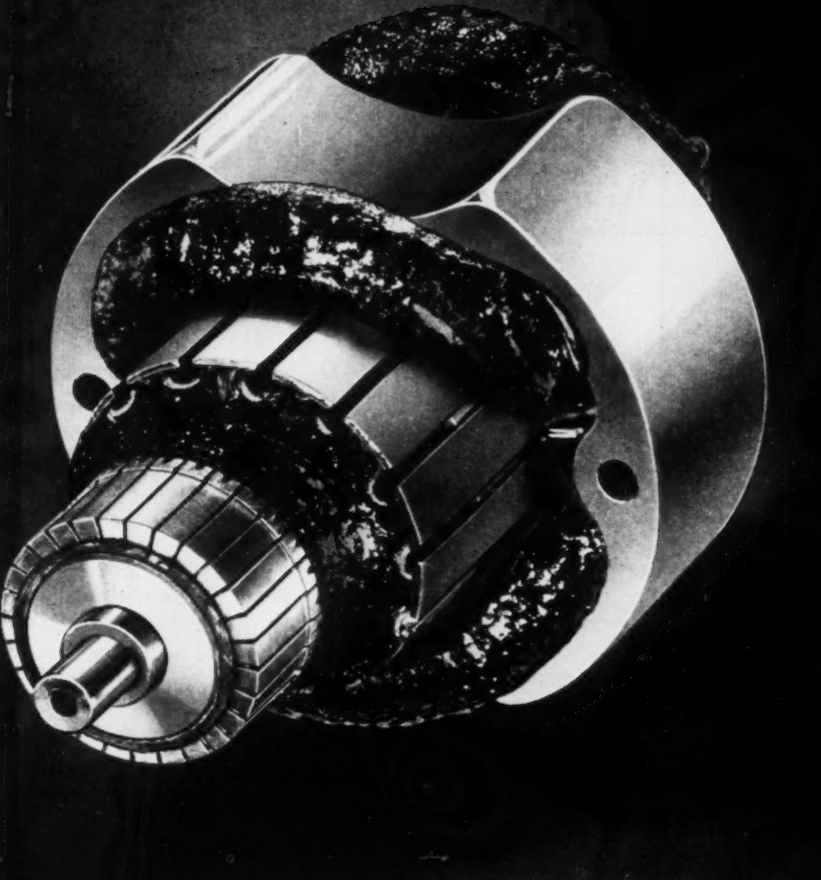
2 SHEARS

4 HAMMERS

4 BENCH GRINDERS

3 SANDERS

1 VACUUM CLEANER



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RECENT TRADE LITERATURE

Continued

scription of scope of company services in design, purchasing, construction presented in new 14 page bulletin No. S-10. Automatic Temperature Control Co., Inc., 5200 Pulaski Ave., Philadelphia.

▶ *CARBON, ALLOY STEEL*—New folder contains chemical analyses for carbon and alloy steel. Company's grade designations broken down into chemical components. Nikoh Tube Co., 5000 S. Whipple St., Chicago 32.

▶ *CENTRIFUGAL PUMPS*—Bulletin 350-29 describes types "HLM" and "HIM" pumps featuring single stage, double suction centrifugal design. Built to handle high static heads. American-Marsh Pumps, Inc., 60 Capital Ave., N.E., Battle Creek, Mich.

▶ *COMPRESSOR*—New 4 page bulletin, form 1540, describes model "20T" compressor equipped with channel valve. Includes cutaway views, table of specifications. Ingersoll-Rand Co., 11 Broadway, New York 4.

▶ *CONDENSATE CONTROL SYSTEM*—Publication 6025 contains data on "C-B" system of condensate control designed for improved heat transfer in process equipment. Cochrane Corp., Philadelphia 32.

▶ *COOLING CONTROL*—Bulletin describes self powered cooling control designed to hold temperature of cooling water in jackets or coils of equipment such as compressors, oil coolers, condensers, stills. Sarco Co., Inc., Empire State Bldg., New York 1.

▶ *COOLING TOWERS*—Features, diagrams, performance data on all aluminum cooling tower presented in 4 page folder. Designed for quiet operation, long life. Jim Knobloch Co., Newport, Ky.

▶ *DUST CONTROL*—Dust control in industries concerned with building materials discussed in bulletin 554-D. Is made up of case histories showing how "Dustube" cloth filter type dust collectors employed. American Wheelabrator & Equipment Corp., 1321 S. Byrkit St., Mishawaka, Ind.

▶ *ELECTRONIC CONTROLS*—Reference guide on electronic controls for heating, ventilating, air conditioning designed to provide information on equipment and components, typical system specifications and connection diagrams, data sheets on control panels. Minneapolis-Honeywell Regulator Co., 2641 Fourth Ave., S., Minneapolis 8.

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FOR YOUR ENTIRE
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WITH A

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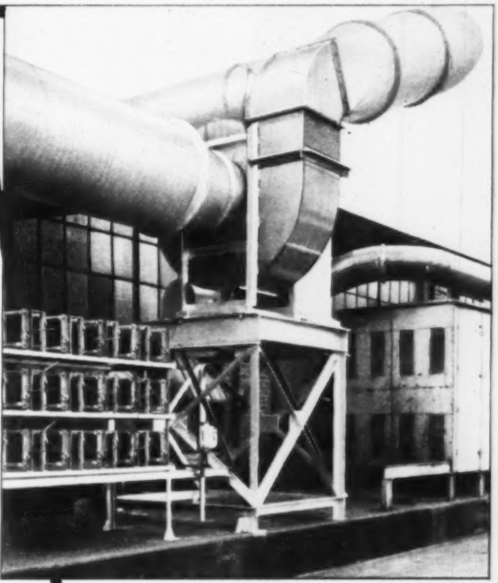
DIESEL ENGINE testing requires safe and effective removal of high-temperature exhaust gases . . . Caterpillar Tractor Co. gets peak performance with carefully engineered exhaust systems serving batteries of engines under test. BAYLEY stainless steel exhaust fans, expressly designed for applications like this, handle the corrosive gases with minimum power, back-pressure, and maintenance.

Results such as these are typical of Bayley's experience in the design and production of air-handling equipment to meet the most exacting requirements.



Stainless steel fan handles 17,000 cfm of 1000° F. diesel exhaust gases.

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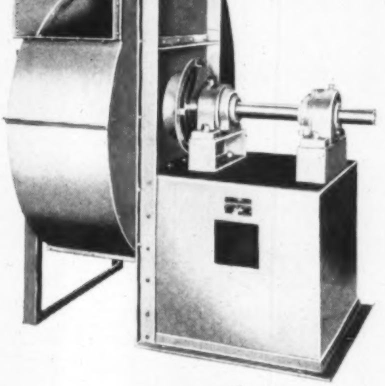

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Bayley Type EX high-temperature fan similar to that used in Caterpillar exhaust system.

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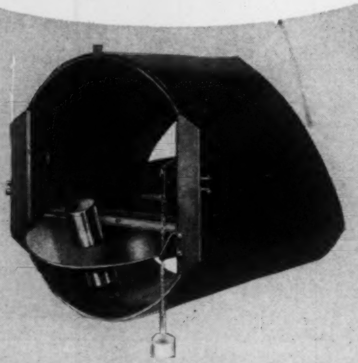

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Continued

▶ *FINNED TUBING*—New 4 page bulletin describes "G-R G-Fin" tube with designed longitudinal fins having much greater exterior surface than same length bare tubes. Contains specification tables on sizes, materials. Griscom-Russell Co., Massillon, Ohio.

▶ *HEATERS*—Infrared radiant industrial heaters and direct fired heaters discussed in two new 4 page bulletins. Specifications given for both. Thermobloc Div. of Prat-Daniel Corp., South Norwalk, Conn.

▶ *HIGHER VOLTAGE DISTRIBUTION*—Higher voltage distribution systems for secondary networks in commercial buildings covered in 24 page brochure. Distribution Assemblies Dept., General Electric Co., Plainville, Conn.

▶ *HOT WATER CIRCULATOR*—Construction, performance features of "Magic Head" hot water circulator described in 12 page catalog. Illustrated with photographs, cutaway drawings. Econo Products Co., East Haddam, Conn.

▶ *ICE ACCUMULATOR SYSTEMS*—Bulletin covers capacity ratings, contains data sheets, cites features and advantages for "Ice Banks" for chilled water applications in air conditioning. King Zeero Co., 4300 W. Montrose Ave., Chicago 41.

▶ *INDUSTRIAL FANS*—New 10 page bulletin 601 details fans for general industrial use. Contains operating, design data. Dracco Corp., Harvard Ave. and E. 116th St., Cleveland 5.

▶ *MASONRY CORE DRILLS*—Drills for tile, concrete, rock, brick, other tough masonry and stone described in 4 page folder. Contains instructions on how to resharpen. Diamond Expansion Bolt Co., Inc., Garwood, N.J.

▶ *MECHANICAL SEAL*—New 8 page bulletin AD-150 contains information including sectional drawings, charts, diagrams for mechanical seal designed for use on rotary shafts at pressures to 150 psi. Garlock Packing Co., Palmyra, N.Y.

▶ *MOLDED RUBBER GOODS, SHEET PACKING*—New 8 page bulletin H-20 contains specification chart comparing six types of natural, synthetic rubber for molded products for original equipment manufacturers; lists 10 types pure gum and synthetic rubber

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pressure burner eliminates nozzle coking

That familiar headache—nozzle coking and plugging—has been eliminated in the new Ray Pressure Combination Burner.

Ray engineers have accomplished this by the development of an exclusive gas-oil ignition system which cleans the oil nozzles in each cycle during extended gas firing periods.

The Ray Pressure Combination Burner also functions efficiently against positive pressure with no loss of capacity. The simplified design of this unit insures easier servicing and more economical operation.

The Ray Pressure Burner is also available in Pressure Diesel and Pressure Type Gas models.

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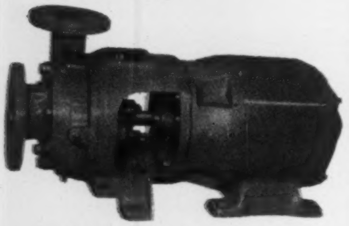

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RECENT TRADE LITERATURE

Continued

sheet packing and recommended uses. Hewitt-Robbins, Inc., 666 Glenbrook Rd., Stamford, Conn.

▶ *MOTOR CONTROL*—Features of "Varitol" control with manufacturer's variable drive motors illustrated in new 8 page booklet. Control is said to improve output, reduce waste. U.S. Electrical Motors, Inc., Box 2058, Los Angeles 54.

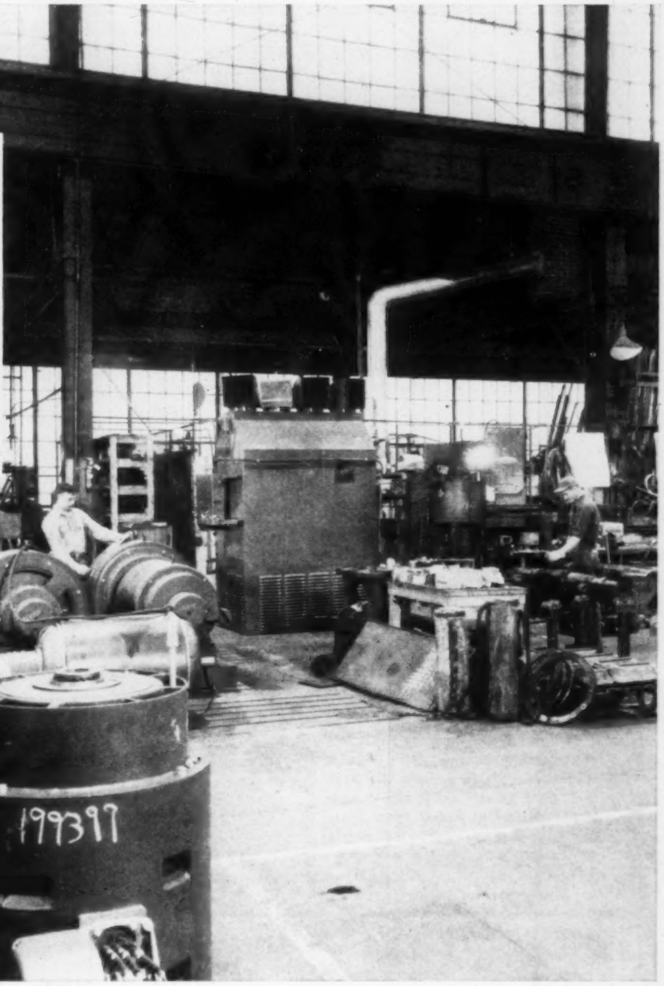
▶ *OIL SEPARATORS*—New 8 page brochure covers oil separators for refrigeration, air conditioning applications. Contains charts, diagrams, specifications. Temprite Products Corp., P.O. Box 72, Birmingham, Mich.

▶ *PIPE, FITTINGS, TUBING*—Characteristics, properties of unplasticized polyvinyl chloride pipe, fittings, tubing in high impact and normal impact types presented in 4 page folder. Contains table of chemical resistances. Easton Plastic Products Co., Inc., 900 Line St., Easton, Pa.

▶ *PIPING*—True Piping Economy is guide for measuring basic cost factors in installation of piping systems. Compares wrought iron, other types of pipe in terms of purchase, installation, maintenance costs. A. M. Byers Co., Clark Bldg., Pittsburgh 22.

▶ *PLASTIC PIPE*—Applications, chemical resistance, installation of polyethylene plastic pipe presented in 16 page bulletin No. 29. Contains chart for determining maximum operating pressures at various temperatures. National Tube Div., U.S. Steel Corp., 525 William Penn Pl., Pittsburgh 30.

▶ *PORTABLE COMPRESSOR*—New 8 page form 2302 covers 36 cfm self contained "Spot-Air" portable compressor, deals at length with tools it will operate. Ingersoll-Rand Co., 11 Broadway, New York 4.



Modern Dravo heating saves this plant $6732 per year, frees 3400 sq. ft. of floor space

Sharp increases in heating costs traveled hand-in-hand with growth and expansion at Ideal Electric and Manufacturing Company's Mansfield, Ohio plant.

As manufacturing additions went on over the years, more and more hand-fired coal stoves were employed to heat new areas. Until recently, heating for the seven-acre plant area was handled by thirty-two such units. Heating problems never seemed to cease. With the lack of uniformity in heating, workers either froze or baked. Coal and labor costs (it took almost the full time of 5 men to fire stoves around the clock) never stopped climbing. Stoves and their bins gobbled up more than 4000 square feet of plant space!

When modern Dravo gas-fired, forced-air space heaters were installed, these problems disappeared, and the savings were immediate and substantial. Since eleven Dravo "Counterflo" heaters provided comfortable heat everywhere in the plant areas, 3600 square feet of valuable space was released ("Counterflo" heaters required only 600 square feet). But, more important was the actual gross savings of $6732 made possible last winter, '54-'55, through the use of these Dravo Heaters. When amortizing this new and standby equipment over a 10 year period, a net savings of $2735 per year is realized!

Remarkable? Then you will want to see for yourself what unusual cost-savings and heating efficiency Dravo heaters can bring to your heating systems. Use the coupon below to get complete details. You'll find it always pays to investigate Dravo Heaters!

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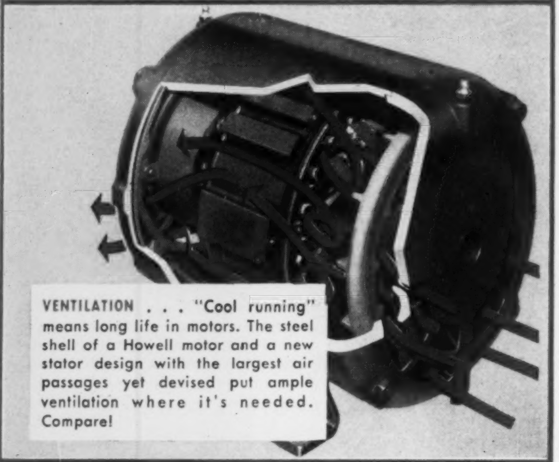
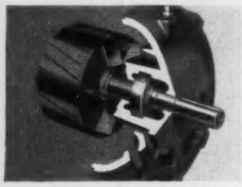
To AIR CONDITIONING ENGINEERS,
Howell suggests

What to look for in Part-Winding Motors

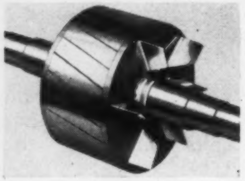
If you've investigated reduced voltage starting of compressors, centrifugal pumps, etc. with part winding (synchronous) motors, you know of the economies and efficiency to be gained.* But, as in other types of motors, manufacturers' constructions differ considerably. Below are some points for comparison . . . and a few of many reasons why Howell motors are so outstanding!



VENTILATION . . . "Cool running" means long life in motors. The steel shell of a Howell motor and a new stator design with the largest air passages yet devised put ample ventilation where it's needed. Compare!



BEARINGS . . . They should be fully protected. Dirt can't enter Howell's double shielded bearings either from inside or outside the motor, because they are sealed in the end plate cavities by dust-tight inner caps. Compare!



COPPER-CLAD ROTORS . . . Howell motors have copper-wound rotors. This means better heat conductivity, stability at high temperatures and, as opposed to die-cast rotors, greater design flexibility to meet your special requirements. Compare!

**Part winding motors reduce starting shock to machine, minimize line disturbances, and offer the advantages of low cost 2- or 3-step starters. A Howell motor specialist will be glad to show you their advantages (and limitations).*

WRITE FOR BULLETIN PW-1

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HOWELL MOTORS

HOWELL ELECTRIC MOTORS CO., HOWELL, MICH.

RECENT TRADE LITERATURE

Continued

▶ *PORTABLE POTENTIOMETER*—Bulletin F 5760-1 describes company's portable potentiometer for checking installations of temperature measurement and control instruments, both in laboratory and field. Barber-Colman Co., Wheelco Instruments Div., Rockford, Ill.

▶ *PORTABLE TOOLS*—New 60 page spring catalog describes over 150 models of portable electric, pneumatic power tools. Includes price schedules. Skil Corp., 5033 Elston Ave., Chicago 30.

▶ *PRESSURE SWITCH*—Bulletin 5409 describes new style "S" pressure switch designed for water systems, low pressure air compressors, paint sprayers, similar applications requiring 1 hp or less. Furnas Electric Co., Batavia, Ill.

▶ *PROCESS CONTROL INSTRUMENTS*—New 21 page catalog No. 2 gives dimensions, capacities, construction details, prices for standardized and stocked process control instruments. Fischer & Porter Co., 397 Jacksonville Rd., Hatboro, Pa.

▶ *PUMPS*—Controlled volume pumps for water treating systems discussed in 24 page bulletin 953. Typical water treating processes, systems described. Milton Roy Co., 1300 E. Mermaid Lane, Philadelphia 18.

▶ *RADIATION*—New 16 page catalog describes company's "Hi-Therm" line of fin pipe radiation. Illustrations, dimensional drawings of single, double, triple tier enclosures given for each of seven models. Stedco Products, 71 Lehigh St., Wilkes-Barre, Pa.

▶ *RECORDING CHARTS*—New 14 page bulletin outlines methods, controls used in producing recording instrument charts. Shows some tests, quality control procedures that go into manufacture of charts. The Bristol Co., Waterbury 20, Conn.

▶ *RUBBER PACKING*—Sheet rubber packing made by company's exclusive process described in 4 page catalog. Includes recommended applications, available sheet, sizes. Boston Woven Hose & Rubber Co., P. O. Box 1071, Boston 3.

▶ *SHEAVES*—Stationary and motion control "Vari-Pitch" sheaves for speed variations to 76 percent by means of pitch diameter adjustment, capacities 1 to 600 hp described in new folder. Allis-Chalmers Mfg. Co., 1171 S. 70th St., Milwaukee.

MODERN COMFORT **in modernized skyscrapers**

Modernized office buildings successfully compete with the newest skyscrapers when they are equipped with the latest air conditioning systems. That's what owners of one New York building concluded in 1950. The result is this strikingly modern facade on the 25-story Herald Square Building.

Chilled water risers **on the exterior of the building** are protected and concealed by a jacket made of durable 18-8 stainless steel.

Branch lines carry the chilled water from the risers into corridors on each floor. Piping is hidden between the original 10-foot high ceiling and the new furred, 8-foot ceiling. Conduits from the branch lines lead to individual air-conditioning units.

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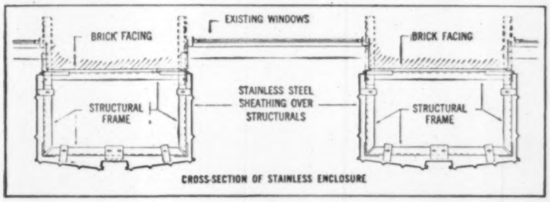
This technique eliminates the cost of cutting through 25 floors to extend the chilled water risers. **And there is no loss of rentable floor space.**



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Many architects also use Armco Stainless Steel to conceal interior ventilating ducts through decorative treatment. They prefer this modern metal for both exterior and interior work because it harmonizes with any building plan or color scheme. Equally important, it stays attractive, holds up under tough usage and corrosive atmospheres, and is easy to keep clean.

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RECENT TRADE LITERATURE

Continued

▶ *SHUTOFF VALVE*—Leaflet describes, diagrams company's series 1245 "Hi-Vac" shutoff valve. Is engineers' drawing showing details of unit. Associated Valve & Engineering Co., 1150 W. Marquette Rd., Chicago 21.

▶ *SOLENOID VALVE*—Description of new low pressure gas solenoid valve presented in technical bulletin 743. Valve designed for handling air, natural and manufactured gas, propane, butane, water, gasoline, light fuel oil, other low viscosity fluids. Automatic Switch Co., 391 Lakeside Ave., Orange, N. J.

▶ *SOLENOID VALVES*—New 6 page bulletin covers company's entire range of solenoid valves. Information on selection, features, coil construction, lift ratings, coil frequencies, etc. listed. A-P Controls Corp., 2450 N. 32nd St., Milwaukee.

▶ *SPACE HEATERS*—Case study No. 560-70 describes how flexibility of oil fired, warm air space heaters were used in designing heating for large terminal. Explains positioning, versatility, air flow. Dravo Corp., 1203 Dravo Bldg., Pittsburgh 22.

▶ *STAINLESS STEEL VALVES*—Twelve page technical data booklet covers stainless steel valve design, selection, maintenance, repair. Includes photographs, drawings, cutaways. Cooper Alloy Corp., Hillside, N. J.

▶ *UNIT COOLERS*—Bulletin No. 109-55 gives physical specifications, application data on "Angle-Air" unit coolers. Tenney Engineering, Inc., 1090 Springfields Rd., Union, N. J.

▶ *VALVE*—New "LQ600" bronze globe valve with Brinell alloy seats, discs described in 4 page circular. Designed to be wear-, corrosion-resistant. Lunkenheimer Co., Box 360, Cincinnati 14.

▶ *VALVES*—Catalog-bulletin illustrates, describes company's valves. Contains specifications, illustrations of typical installations. Greenwood Valve Div., Vernon Tool Co., Ltd., 1101 Meridian Ave., Alhambra, Calif.

▶ *VALVES, FILTERS, DRIERS*—Company's annual refrigeration valve catalog increased to 20 pages. Illustrates and describes entire line. Contains charts, selection data, capacity tables. A-P Controls Corp., 2450 N. 32nd St., Milwaukee.

▶ *VENTILATING FANS*—Line of "Rex-Airate" ven-

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Send for your FREE copy of Western's new Ventilation Nomogram! It's the greatest little Architect and Engineer-saver since the invention of the engineering assistant! No longer is it necessary to put up with the annoying whir and clatter of an adding machine, or the tedious juggling of a slide-rule! Time wasted in manipulating the factors of structure, cost, capacity, and exhaust rate can be cut from hours to minutes! Send for yours today!

WESTERN ENGINEERING & MFG. CO.

4116 Ocean Park Ave., Venice, Calif.

and after the calculations are made, here's the ventilator to solve your air-exhaust problems—Western Rotary's newest Turbo-ventilator. In addition to Western's traditionally unsurpassed quality, the following exclusive new advantages are offered:

RUBBER MOUNTINGS completely isolate head from throat - no noise or vibration can be transmitted.

LOCKED-ON ROTOR prevents loss or damage in highest wind

PATENTED * BEARING suspension-radial thrust ball-bearing keeps friction loading low so that momentum keeps head spinning in gusty conditions.

BAKED ENAMEL finish in soft sea green—blends with any exterior.

PERMANENTLY SEALED weatherproof casing protects upper and lower bearings from airborne dust and grit.

WOOL-PACKED lubricant reservoir is oversized to ensure years of operation with minimum maintenance under most severe conditions.

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PLEASE SEND ME MY NOMOGRAM IMMEDIATELY
NAME ____________________
ADDRESS ____________________
COMPANY ____________________

Ramset SAVES $11,000

FASTENING SYSTEM

for Fastening Air Ducts in Texas' Largest Store

More than two miles of air conditioning ducts were installed with RAMSET SYSTEM in the new addition to Joske's Department Store at San Antonio, Texas, the "largest store in the largest state."

By using RAMSET Jobmaster, anchoring studs were set at the rate of better than 1 per minute, instead of an estimated 15 minutes each by old-fashioned, conventional methods. Substantial cost savings were thus gained, as well as a far faster, completely secure installation. Similar results were obtained for hanging 13 miles of sprinkler piping and anchoring 43 miles of electric conduit.

Ask your dealer or write us for details on how you can make more profit from every job by using RAMSET SYSTEM.

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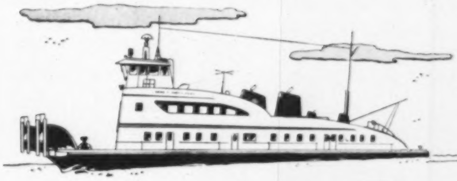
Ramset Fasteners

Ramset Fasteners, Inc.

RAMSET DIVISION • OLIN MATHIESON CHEMICAL CORP.
12109 BEREA ROAD • CLEVELAND 11, OHIO

FIRST IN POWDER-ACTUATED FASTENING



in *Shipbuilding* as in other great industries **MILLER WELDERS** are preferred

Miller Selenium Rectifier type D.C. Arc Welders are available in four wide range models. For complete information on these and other Miller arc and spot welders, contact us today at no obligation, of course.

St. Louis Shipbuilding and Steel Co., largest builders of inland towboats in the world, require welds that will withstand a maximum amount of abuse.

Look anywhere in St. Louis Shipbuilding's mammoth yard and you will see Miller Selenium Rectifier type D.C. arc welders — in single units or in batteries of four and five for greater output.

For dependable welds, St. Louis Shipbuilding prefers the Miller S.R. welder Miller is glad to be aboard.

ARC • SPOT miller GENERATORS WELDERS

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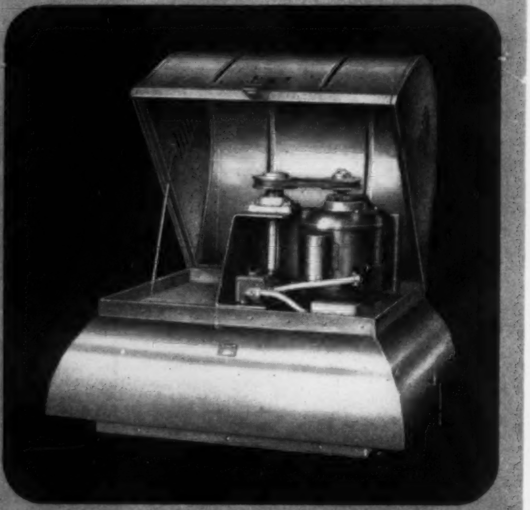
ELECTRIC MANUFACTURING CO., INC.
APPLETON, WISCONSIN

DISTRIBUTED IN CANADA BY

CANADIAN LIQUID AIR CO., LTD., MONTREAL, P.Q.

ALADDIN
Centrifugal
ROOF VENTILATORS



- **THIRTEEN SIZES**
- **SELF CONTAINED**
- **QUIET OPERATING**

Certified Ratings
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ALADDIN Centrifugal Roof Ventilators are furnished in thirteen sizes . . . direct and belt driven. Ruggedly built, these units have been designed especially for those installations where positive year around powered ventilation is required.

ALADDIN Roof Ventilators are described in the first complete engineering bulletin yet published on similar units. This bulletin contains full performance tables, characteristic curves and other data required for the proper selection of such equipment.

WRITE FOR BULLETIN 410

ALADDIN HEATING CORPORATION
1111 WEST AVENUE 137 • SAN LEANDRO, CALIF.
REPRESENTATIVES IN ALL PRINCIPAL CITIES IN THE WEST

RECENT TRADE LITERATURE

Continued

tilating fans for 1955 shown in 14 page catalog. Illustrates seven models for commercial, industrial use, both belt driven and direct drive. Air Controls, Inc., 2310 Superior Ave., Cleveland 14.

▶ *WATER ENGINEERING—Cracking and Embrittlement* is 6 page booklet outlining water system trouble spots, factors that can produce breakage, failure. Company's preventative service detailed. Hall Laboratories, Inc., 323 Fourth Ave., Pittsburgh 30.

▶ *WATER HEATERS*—Advances in volume hot water heating with company's "WH" series self contained twin coil volume water heater line explained in new bulletin. Portmar Boiler Co., Inc., 193 Seventh St., Brooklyn 15.

▶ *WELDING*—"Aircospot" inert-gas-shielded tungsten-arc spot welding process described in 12 page reprint. Contains tables, drawings, graphs, weld cross section and application photographs. Air Reduction Sales Co., Div. of Air Reduction Co., Inc., 60 E. 42nd St., New York 17.

▶ *WELDING—A New Welding System* is new 32 page manual designed as guide to use of "Croloy" electrodes for welding of pipe, equipment subject to high temperature, high pressure service. Metal & Thermit Corp., 100 E. 42nd St., New York 17.

▶ *WELDING, CUTTING*—Over 100 welding, cutting technical reprints, text books, safety booklets, slide films, movies briefly described in 16 page booklet. Order cards for requesting items included. Air Reduction Sales Co., Div. of Air Reduction Co., Inc., 60 E. 42nd St., New York.

Address Changing? Tell Us AT ONCE!

A new postal regulation relating to the handling of undelivered mail may result in some issues of *Heating, Piping & Air Conditioning* being thrown away instead of being returned to us — as they have been in the past — for remailing to your new or correct address.

To avoid missing any issue of *Heating, Piping & Air Conditioning* it is more important than ever to report both your new and old address to us and your post office. Deadline is the 8th of the preceding month for the next issue. Send changes — and new local postal delivery zone — to

HEATING, PIPING & AIR CONDITIONING
6 N. Michigan Ave., CHICAGO 2, ILL.

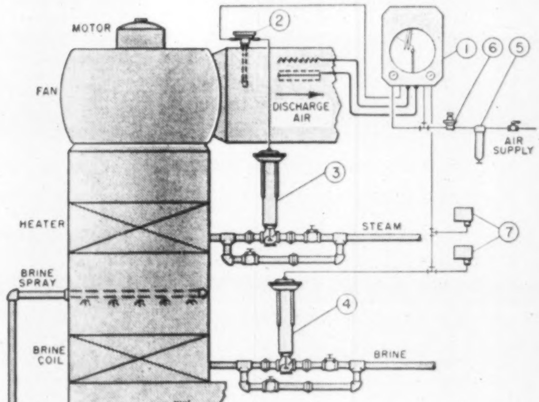
How cold is CORRECT?

IN meat packing and storage rooms, *correct* temperatures are vital. The maintenance of that temperature *constantly* has a great bearing on product marketability and profitable operation. The Taylor control system shown below will not only do this, it will also maintain the right humidity. Result—money saved on shrinkage losses and operating costs.

In this system a Taylor Recording Wet and Dry Bulb Temperature Controller operates valves in the brine or ammonia inlet lines and a humidifying valve in the steam line. It gives a permanent record of both the room temperature and humidity.

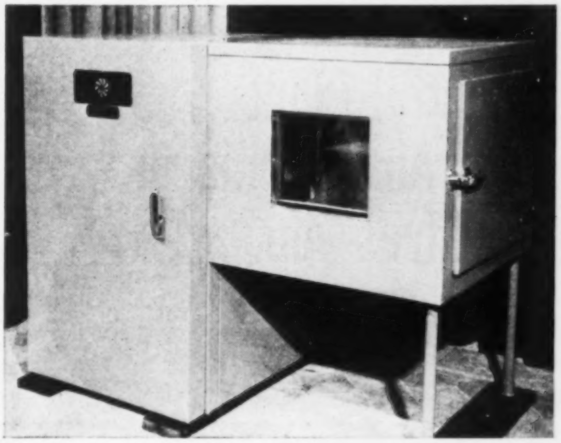
For information about this and many other Taylor control systems for Air Conditioning, Heating and Ventilating, write for **Catalog 5**—or call your Taylor Field Engineer. Taylor Instrument Companies, Rochester, N.Y., or Toronto, Canada.

Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.



Taylor Instruments
MEAN ACCURACY FIRST

NEW NIAGARA



AIR CONDITIONED TEST CABINET

USES—to determine effects of controlled temperature and humidity conditions on test subjects of all kinds—to test processes—to find optimum conditions.

RANGE—With water and electric power services only, the range is from freezing temperature up to 150°F (dry bulb). With refrigeration, and using Niagara No-Frost Liquid to prevent freezing of sprays, you achieve dew point temperatures as low as minus 30° F. Control of relative humidity from 5% to 95% is obtained at all temperatures in this range. Air capacity is 200, 400 or 600 c.f.m.

METHOD—Air is saturated in the air-conditioning unit at the required dew point temperature and reheated to the desired dry bulb temperature. This is the method of the Niagara Type A Air Conditioner which has been proven for the most exacting duty over twenty-five years.

CONTROL—The dew point thermostat is located in the air stream, the dry bulb thermostat in the test cabinet. No moisture sensitive instruments are needed. Recorders may be used to obtain a complete record of conditions.

TEST CABINET—(inside) dimensions are 30" x 28" x 24" with access clear opening 26" x 22". Insulation is the equivalent of 4" cork.

AIR CONDITIONING UNIT is enclosed in an insulated cabinet adjoining the test cabinet. A door the full size of the cabinet wall gives complete access.

Write for Complete Information. Address Dept. HP

NIAGARA BLOWER COMPANY
405 Lexington Ave. **New York 17, N.Y.**
District Engineers in Principal Cities of United States and Canada

Only the

d-h Flexazone

Central-Plant
Air Conditioner
Gives you

24 ARRANGEMENTS!

ZONES EASILY FIELD ALTERED!

HORIZONTAL OR VERTICAL DISCHARGE!

PLUS
D-H EXCLUSIVE DAMPER ARRANGEMENT

Gives independent, variable control for as many as 7 separate zones

Flexibility—that's the *extra* you get with Flexazone! Only Flexazone can be assembled 24 different ways, depending upon available space—*in the field.* Only Flexazone allows you to add or change zones at any time—*in the field.* And only Flexazone gives you a choice of horizontal or angular air flow from the plenum. These *exclusive* features pay off in cheaper installation, greater design-freedom and lower costs—important benefits, whether you're a contractor, architect, engineer, or building owner!

Want to learn more about Flexazone? Write for bulletin C-4.22.

d-h SINCE 1910

drayer-hanson
INCORPORATED
3301 MEDFORD STREET, LOS ANGELES 63, CALIFORNIA
Subsidiary of National - U. S. Radiator Corp.

WHO'S WHAT . . .

▶ *STERLAIRCO, INC.*—Elected to the board of directors of the newly formed company are: Earl A. Darr (Chairman), David E. Feinberg and William Moiselle, all of U.S. Air Conditioning Corp.; John E. Reed and G.H. Stenner of Sterling Radiator Co., Inc.; and C.E. Scott of Sterlairco. The new company is a jointly owned subsidiary of usAIRco and Sterling and was formed to take over the manufacture, sales and distribution of gas fired unit heaters.

▶ *MIDWEST PIPING CO., INC.*—Eric A. Kerbey, president. Mr. Kerbey has been with the company since 1928. He succeeds A.G. Stoughton, president of the company since its formation, who will continue as chairman of the board and executive committee.

▶ *CRANE CO.*—Frank F. Elliott, president and chief executive officer; George G. Lindholm, manager of the valve and fitting department.

▶ *FAIRBANKS CO.*—Alexander L. Naylor, president. Mr. Naylor has been executive vice president for the past 10 years. He succeeds his father, George M. Naylor, who died this year.

▶ *DRAYER-HANSON, INC.*—Fred E. Schmuck, national sales manager.

▶ *WM. POWELL CO.*—H. James Coombe, chairman of the board of directors. Mr. Coombe is president of the company.

▶ *PENN BOILER AND BURNER MFG. CORP.*—C. M. Lane, sales manager.

▶ *ROBERTSHAW-FULTON CONTROLS CO.*—Cecil Latham, assistant superintendent of the Fulton Sylphon Div.; William F. Cathcart, appointed to special engineering duties at the Robertshaw Thermostat Div.

▶ *SQUARE D CO.*—James F. Magin, general manager of the company's Industrial Controller Div. He is vice president and a director of the company.

▶ *SERVEL, INC.*—Richard S. Testut, assistant to the president and director of business planning.

▶ *TUBE TURNS*—Edward F. Harrington, to the staff of the company's sales development department.

RITE "LIME-LITE" with built-in heat Exchanger, having full boiler output.

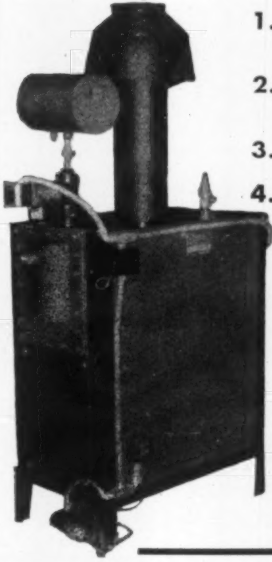
THE "Rite" STORY BEHIND THE "Rite" TRADE MARK

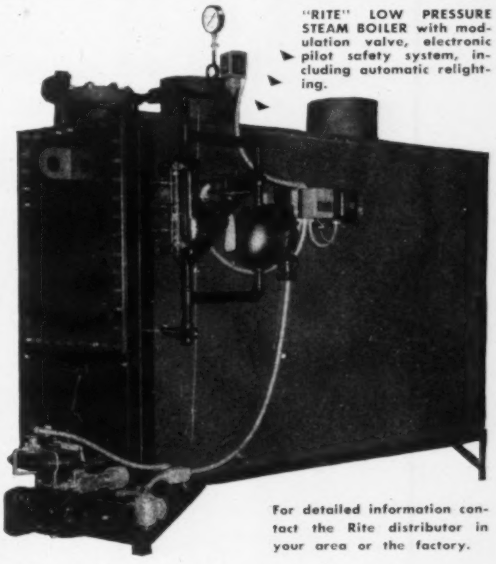
1. 18 water heating and low pressure steam heating boilers up to 2,000,000 BTU, AGA approved.
2. 35 sizes each in water and in steam boilers, gas-fired, oil-fired, and gas-oil combination fired:
3. from 3½ horsepower up to and including 300 horsepower.
4. Oil-fired boilers equipped with soot scrapers making it possible to clean the boiler without disassembly simply by moving the rod back and forth a few times.

★ HOT WATER SUPPLY

★ HEATING STEAM & WATER

★ HEATING & SUPPLY OUT OF SAME BOILER ★ HI-TEMP WATER HEATING ★ 140° F — 180° F WATER FROM SAME BOILER





"RITE" LOW PRESSURE STEAM BOILER with modulation valve, electronic pilot safety system, including automatic relighting.

For detailed information contact the Rite distributor in your area or the factory.

Rite ENGINEERING AND MANUFACTURING CORPORATION
144 South Mission Road Los Angeles 33, California

INDUSTRIAL
VENTILATION
HANDBOOK

A practical manual on fume removal, dust collecting, ventilating and exhaust systems for industrial plants. Tells how to design correctly and provide for various ventilation requirements . . . make measurements and analyses of fumes, mists and dusts . . . plan exhaust systems, etc. Twenty eminent authorities contributed also to detailed descriptions of systems in actual operation in many plants, whatever the manufacturing process. 134 pages of practical "know-how" reprinted from HP&AC. Send your order with only $1.50 to get it postpaid from

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CARVER has the PUMPS... TO FIT YOUR NEEDS!

Whatever your requirements, there is a pump in CARVER'S Complete Line that will give you outstanding performance over a wide range of capacities and heads. CARVER . . . your best buy for better pumping.

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1460 Hershey Ave.
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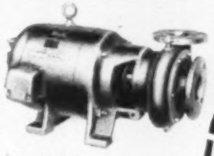
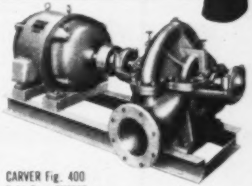
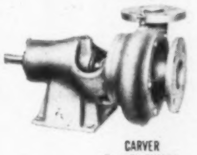


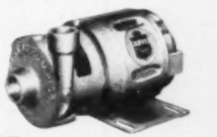
CARVER
L & H PUMPS
30 to 900 G.P.M.



CARVER Fig. 400
Split-Case PUMPS
200 to 2000 G.P.M.



CARVER
Type FL PUMPS
20 to 900 G.P.M.



CARVER
MODEL B PUMPS
6 to 150 G.P.M.

CARVER Model KF PUMPS
Self-Priming
20 to 4000 G.P.M.

Ask for bulletins

CARVER
the quality name in pumps

WHO'S WHAT

Continued

▶ *AIR CONDITIONING AND REFRIGERATION INSTITUTE*—Newly elected officers: James Emmett, Jr. of Jas. P. Marsh Corp., president; M.M. Lawler of Worthington Corp., vice president; Lud Emde of Temprite Products Corp., treasurer. New directors elected for three year terms are: C.E. Buchholzer, Airtemp Div., Chrysler Corp.; C.V. Gary, Henry Valve Co.; E.B. Maire, Penn Controls, Inc.; B.A. Mitchell, Mitchell Mfg. Co.; R.J. Powell, Marley Co.; L.W. Smith, Frigidaire Div., General Motors Corp.; Mr. Emde.

▶ *KINNEY MFG. DIV., NEW YORK AIR BRAKE CO.*—John J. Fox, vacuum systems engineer for application of high vacuum systems in industrial processing; Zbigniew Dobrowolski, project engineer for development of rotary and high vaccum pumps; William B. Mills, assistant sales manager; Joseph P. G. Davis, Philadelphia district manager, succeeding Mr. Mills.

▶ *BYRON JACKSON CO.*—Robert Harcus, appointed to the Membership Advisory Council of the Atomic Industrial Forum. He is executive vice president of Byron Jackson.

▶ *PERFECTION INDUSTRIES, INC.*—Donald S. Smith, recipient of a 1955 Horatio Alger Award. Mr. Smith is president of Perfection.

▶ *H. K. PORTER CO., INC.*— M. J. Ross, manager for export trade for the company's Quaker Rubber Corp. and Watson-Stillman Co. divisions.

▶ *PEERLESS PUMP DIV.*—Carl L. Nickel, product sales manager for water systems and dealer line products; Norman C. Olson, sales manager for engineered line products.

▶ *WOLVERINE TUBE DIV. OF CALUMET & HECLA, INC.*—John Van Wagoner, new responsibilities in the division's advertising department.

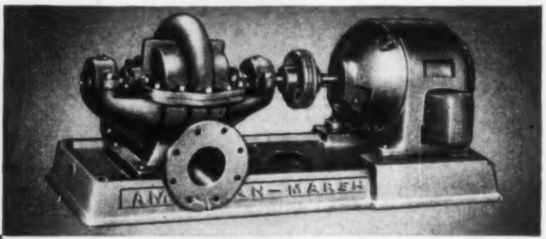
▶ *WHITE-RODGERS ELECTRIC CO.*—Frank Tanler, national sales representative cooperating with regional sales managers.

▶ *PHILIP CAREY MFG. CO.*—Edward C. Meisner, general manager of the company's Plymouth Meeting, Pa. plant.

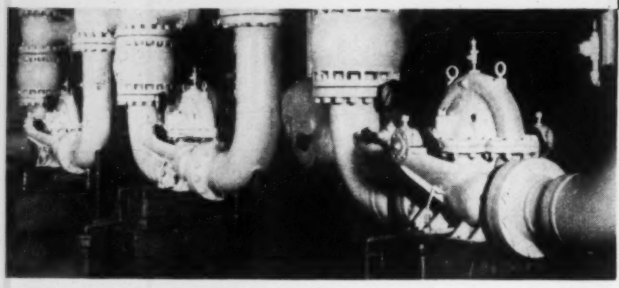
▶ *AMERICAN CHAIN & CABLE CO.*—H. L. Cummings, general manager of R-P&C Valve Div.

Install American-Marsh

PUMPS LIKE THIS



Conventional stuffing box or mechanical seals.



Above — Three bronze-fitted American-Marsh Centrifugals, with direct drive 150 HP motors, each circulate up to 2,000 GPM of chilled water in air conditioning system.

on vital heavy-duty

JOBS LIKE THIS

FOR PERMANENT SATISFACTION!

WHEN YOU SELECT or recommend an American-Marsh Pump, you know it's backed by 80 years' experience in building pumps — and pumps only! WHEN YOU INSTALL it, you know it was individually factory tested to meet all specifications before shipment. (*Every* A-M pump is fully tested!) IF YOU'D LIKE suggestions on the best type and size for *your* job, call your American-Marsh representative. He'll help make sure *your* pump gives permanent satisfaction!

WRITE FOR BULLETIN 350 for details of Model HLM above — or describe your application.

AMERICAN-MARSH PUMPS

BATTLE CREEK MICHIGAN

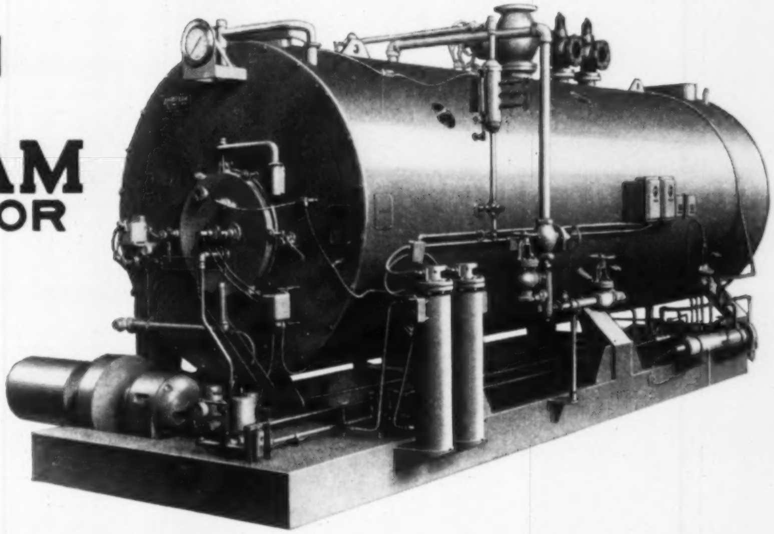
In Canada:
American-Marsh Pumps (Canada) Ltd., Stratford, Ont.

CENTRIFUGAL, TURBINE, STEAM AND POWER PUMPS FOR TESTING, PROCESSING, BOILER FEED, FIRE PROTECTION, ETC

GET ALL THESE ADVANTAGES

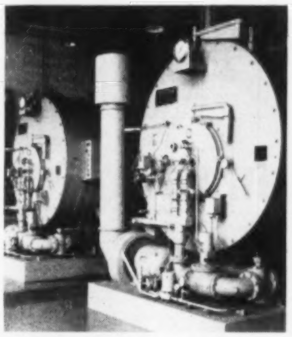
WITH AN

AMESTEAM GENERATOR



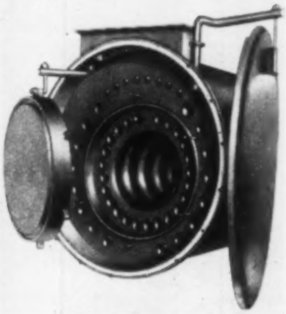
For:
PROCESSING
HEAT — POWER

20 sizes, 10 to 600 H.P., 15 to 200# W.P., oil, gas or oil-gas combinations with quick fuel switchover feature.



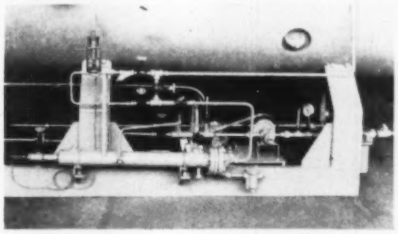
FULLY ASSEMBLED

All piping, wiring and operating parts completely assembled and tested at factory — units shipped in ready-to-fire condition!



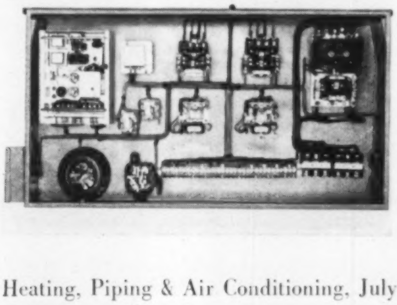
EASY TO CLEAN

Ames-designed davit hinged flue covers and baffle provide quick and complete access to the furnace and all tubes.



AMPLE ROOM

underneath for servicing auxiliary equipment. Control panel at eye level.



AUTOMATIC

operation, fully safeguarded, is provided by factory installed and tested control system.

SAVINGS IN FIRST COST!

Your purchase price includes complete unit — no hidden "extras" to buy later on!

SAVINGS AT INSTALLATIONS

Just set on level concrete floor, connect to service lines and breeching. Nothing to assemble. No brick work required.

SAVINGS IN OPERATION

A minimum of supervision — lower manhour requirements for maintenance — easily replaced inexpensive plastic refractories — 80% thermal efficiency.

Write for bulletin today!

AMES IRON WORKS, INC.
Oswego, N. Y., Box D-75

Gentlemen:

Please send me further information on AMESTEAM GENERATORS and name of nearest representative.

NAME

COMPANY

ADDRESS

AMES IRON WORKS INC.

BOX D-75 **OSWEGO, N. Y.**

WHO'S WHAT

Continued

▶ *REFRIGERATION INDUSTRY SAFETY ADVISORY COMMITTEE*—Carl F. Brooks of Frigidaire Div. of General Motors Corp., chairman; R.L. Williams of Kinetic Chemicals of Wilmington, Del., vice chairman; George S. Jones, Jr. of Air Conditioning and Refrigeration Institute, treasurer.

▶ *TRANE CO.*—Thomas S. Parker, to the company's service department.

▶ *TURNER BRASS WORKS*—Harold V. Engh, president. Mr. Engh succeeds John Slezak, resigned. He was formerly president of Pyle-National Co.

▶ *CHELSEA FAN & BLOWER CO., INC.*—Albert E. Ott, merchandise manager. He will act as the assistant to the executive vice president.

▶ *FLEXIBLE TUBING CORP.*—William Gibb, Jr., secretary of the corporation.

▶ *FOXBORO CO.*—C. C. Fuller, vice president; H. O. Ehrisman, general sales manager; J. J. Burnett, field sales manager.

▶ *BAYLEY BLOWER CO.*—George E. Szekely, general manager.

▶ *BLAW-KNOX CO.*—A. E. Hohman, coordinator of special sales activities; Paul F. Vollmer, advertising manager succeeding Mr. Hohman.

▶ *DAY & NIGHT DIV., CARRIER CORP.*—Lewis G. Elia and Donald R. Starin, to sales engineering staff; Frank R. Spratt, California regional manager.

▶ *HANDY & HARMAN*—M. W. Townsend, appointed to the board of directors. Mr. Townsend is assistant to the president.

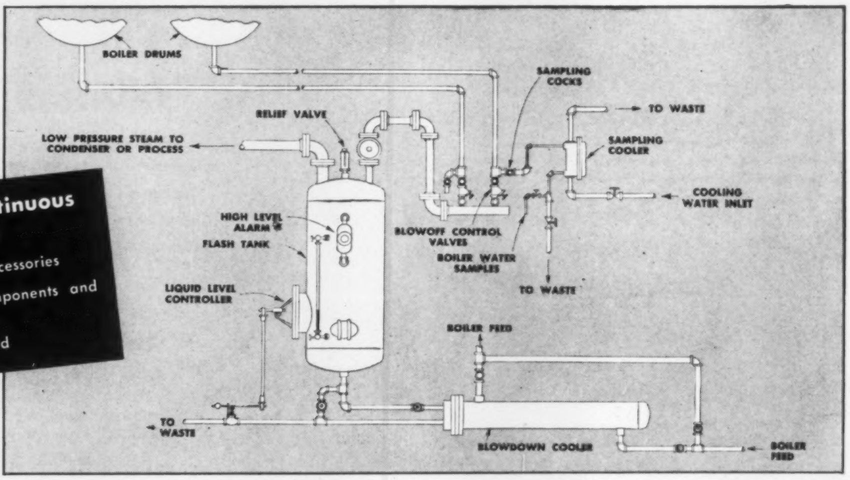
▶ *ALBERT KAHN ASSOCIATED ARCHITECTS & ENGINEERS*—R. E. Linton and S. King, elected to the board of directors.

▶ *KULJIAN CORP.*—Hilton A. Levonian, vice president in charge of consulting engineering.

▶ *ROCKWELL MFG. CO.*—Paul C. Kreuch, vice president in the meter and valve division; Eugene F. Foubert, vice president in charge of industrial relations.

Maintain Proper Boiler Water Concentrations –

FOR ECONOMICAL BOILER OPERATION


BOILER DRUMS
SAMPLING COCKS
TO WASTE
RELIEF VALVE
LOW PRESSURE STEAM TO CONDENSER OR PROCESS
SAMPLING COOLER
COOLING WATER INLET
HIGH LEVEL ALARM
FLASH TANK
BLOWOFF CONTROL VALVES
BOILER WATER SAMPLES
TO WASTE
LIQUID LEVEL CONTROLLER
BOILER FEED
TO WASTE
BLOWDOWN COOLER
BOILER FEED

Standard WHITLOCK Continuous Blowdown System

ECONOMICAL: standard low cost accessories

COMPLETE: with all operating components and controls carefully selected

AUTOMATIC: no attendance required

This Continuous Blowdown System automatically provides effective, low-cost boiler protection. Ask us to recommend a unit engineered for your plant.

Whitlock

THE WHITLOCK MANUFACTURING COMPANY
44 SOUTH STREET • WEST HARTFORD 10, CONN.
New York • Boston • Chicago • Philadelphia • Detroit • Richmond
Authorized representatives in other principal cities
In Canada: Darling Brothers, Ltd., Montreal

Designers and builders of bends, coils, condensers, coolers, heat exchangers, heaters, piping, pressure vessels, receivers, reboilers.

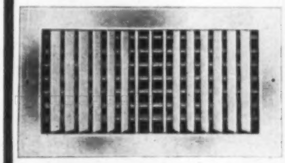
"GENERAL"

the name that stands for . . . QUALITY in air conditioning

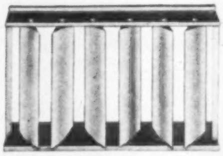
REGISTERS and GRILLES

Already acclaimed one of the leaders in the commercial grille field, the consistent quality of General products is bringing the name "preferred acceptance" across the country—with those who know.

G-R precision workmanship—and mass output—are the result of the finest in high-production facilities. Investigate the line that's—"Second to None."

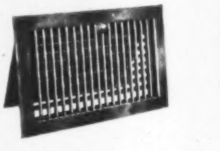


EVERYTHING STREAMLINED
General adjustable registers and grilles are streamlined throughout for appearance and operating efficiency, including fins, damper blades, and radius edges of the solid frame.

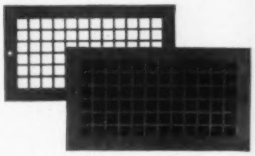


***Silentite* DAMPER**
Standard on General registers or furnished separately, the *Silentite* opposed-blade damper controls volume without turbulence. Reinforced hollow blades of great strength allows positive gripping of bearings for easy action without rattling.

Cross section shows streamlined contour.



"RANCH HOME"
Adjustable residential winter-summer heating-cooling model.



STAMPED GRILLES
Plain Lattice, Pencil-proof (schools), Sanitary (hospitals).

DUCTROL
Line includes air directors, mounting frames, fusible links, door grilles, various accessories, metals and finishes.

A Complete Line
For Cooling and Ventilating

Write for Catalog On Your Letterhead

GENERAL REGISTER
CORPORATION
14 Factory Street Cedar Grove, N. J.

this "mile-long"* warehouse

* Parr Franconia Warehouse

depends upon

PENN VENTILATORS

for quiet, steady air removal

Penn Airette

. . . performance plus appearance . . . make Penn Airettes a popular partner on many important projects. These self-contained propeller fan roof ventilators come on the job as a complete package — ready for installation. They feature clean contours, substantial weatherproof housings, Direct or V-Belt Drives, Capacities from 400 to 40,000 cfm.

Your Penn Ventilator man will be glad to show you more about this exhauster or any of the other products in Penn's complete line of powered and gravity roof ventilators.

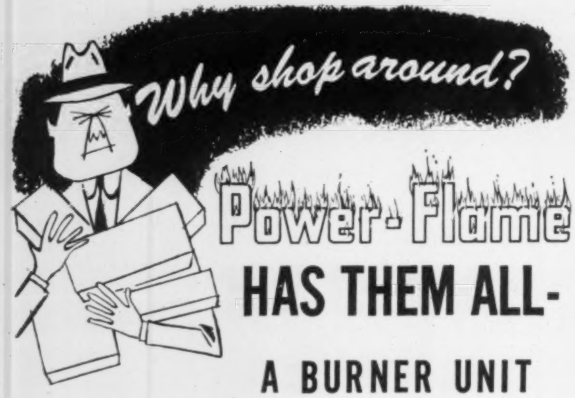
Complete Literature Available Write to Engineering Department

PENN VENTILATOR COMPANY

Representatives and Distributors in principal cities

PHILADELPHIA 40, PENNA.

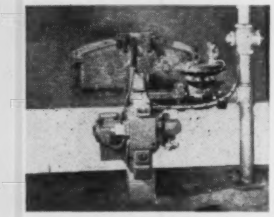
FOR MORE THAN 25 YEARS
THE BUILDERS' roof TOP LINE



HAS THEM ALL-

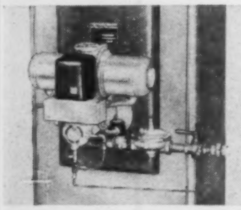
A BURNER UNIT
TO FIT EVERY APPLICATION!

Regardless of application . . . commercial, industrial or domestic . . . there's a POWER-FLAME BURNER engineered to give *superior performance more economically*



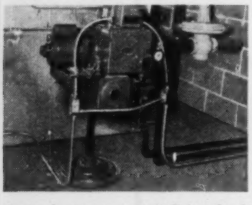
A box manufacturer in Pittsburg required continuous low cost steam. Of course he chose this compact Power-Flame Burner.

BFG Series—Outstanding in the industry, with these advanced features: factory wired-controls and valves mounted... wired sequencing panel provides purge period for utmost safety... positive control of air for combustion. 8 easy-to-install models in capacities from 450,000 BTU to 9,000,000 BTU input. Large capacities for heating or power processing.



Another example of an oil fired furnace converted to gas with Power-Flame.

FG Series—POWER-FLAME'S answer to the homeowner. An inexpensive replacement of oil burner for the small or large home or small industrial application. 3 gun type units... Model FG 175 capacity to 175,000 BTU, AGA listed; Model FG 330, capacity to 330,000 BTU, AGA listed; Model FG 500, capacity to 500,000.



A single compact unit firing both gas and oil. A clothing store in Missouri elected the Power-Flame FGO 3500 for uninterrupted heating service.

FGO Series—POWER COMBIMATIC gas-oil—6 models—for gas and light oil in capacities to 3,500,000 BTU input. Features include... automatic ignition for both fuels... automatic air adjustment... electronic safeguard... factory assembled and tested for both gas and oil. Automatic or manual changeover optional.

A Power-Flame Dealership can be valuable; write today for complete information

Power-Flame BURNER

A Division of
Siemon Manufacturing Company • Grandview, Mo.

WHO'S WHAT

Continued

▶ *WORTHINGTON CORP.*—William J. Millett, assistant vice president in charge of manufacturing of the air conditioning and refrigeration division; Hellmuth Walter, director of research; Robert S. Sherwood, assistant director of research; Peter J. Dalton, product manager of the air conditioning and refrigeration division's packaged products section. Former director of research Ralph M. Watson is leaving Worthington to become Associate Dean of the L.C. Smith College of Engineering and Chairman of the Dept. of Mechanical Engineering at Syracuse University.

▶ *COPELAND REFRIGERATION CORP.*—Frank J. Gleason, executive vice president.

▶ *AIR-CONDITIONING AND REFRIGERATION INSTITUTE*—A. Migliaro, public information director.

▶ *A. W. CASH CO.*—H. M. Kirkby, director of marketing.

▶ *INTERNATIONAL NICKEL CO., INC.*—M.D. Bellware, a member of the welding group of the development and research division's technical service section; Leon M. Petryck, a research metallurgist in the welding section of the research laboratory at Bayonne, N.J.

▶ *L.O.F. GLASS FIBERS CO.*—Robert V. McCallister, sales manager for equipment and industrial sales; Richard K. Trask, manager in charge of distributor and acoustical sales; Hugh W. Paul, manager of technical sales service; Milton W. Gregory, manager of bonded mat sales.

▶ *LINCOLN ENGINEERING CO.*—Alton F. Davis, recipient of a "Distinguished Alumnus" award for 1955 from Ohio State University.

▶ *RHEEM MFG. CO.*—John F. Fraser, Jr., sales promotion manager; Robert L. Anderson, to the market research department of general sales, heading research activities on plumbing and heating products.

▶ *SERVEL, INC.*—A.B. Kennison, a vice president coordinating research and product development.

▶ *STEWART-WARNER CORP.*—Edgar L. Conn, manager of manufacturing for the company's South Wind Div. in Indianapolis.

For EVERY CONDENSATE RETURN JOB

AURORA

has the COMPLETE ANSWER

For example

APCO-MATIC VERTICAL

- COMPACT
- EFFICIENT
- QUIET
- DURABLE
- DEPENDABLE

CONDENSATE RETURN UNIT

These APCO-MATIC's combine the latest features in vertical turbine-type pump design with small space, quiet dependability, completely automatic condensate return with a minimum heat unit loss. Available for heating systems rating from 800 to 10,000 EDR and pressures up to 50 P. S. I.

✓

CHECK THESE DISTINCTIVE FEATURES

•

Write for BULLETIN 113-LR

LOW RETURN OPENING
Convenient for connection to close-to-the-floor return lines.

DUAL DISCHARGE OPENINGS
Provide optional connection for piping to boiler.

BRONZE PUMPING UNIT
Insures long life and no deterioration of pump parts by corrosion.

COMPACTNESS
Rectangular receiver — maximum capacity — minimum space.

QUIET OPERATION
Close coupled pump is quiet. Pump and Motor mounted on rubber.

MECHANICAL SEAL
Eliminates all leakage. Keeps floor dry and clean.

MAINTENANCE
Replacement of worn parts or complete unit without disturbing piping connections.

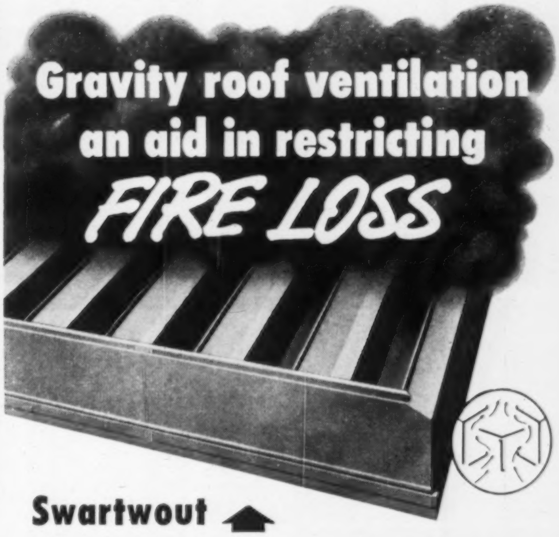
OTHER CONDENSATE RETURN UNITS by AURORA

Whether returns are high, low or below floor level Aurora has horizontal and vertical units, simplex and duplex, for practically every size of condensate return problem. Describe your applications; we'll send you bulletins.

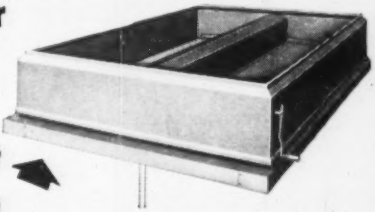
Complete Information on Request

DISTRIBUTORS IN PRINCIPAL CITIES

AURORA PUMP DIVISION
THE NEW YORK AIR BRAKE COMPANY
80 LOUCKS STREET AURORA · ILLINOIS



Swartwout Airmover



Swartwout Fire Valve

The new technique—

"Escape" Ventilation

lets smoke and fumes OUT and UP —helps keep fire from spreading

The worst handicap to fighting fire, according to firemen, is dense smoke and fumes created by burning materials, oil, chemicals, etc. that *hide the flames!* Reveal the flames, they say, and they can fight more successfully and limit fire spread.

Fire authorities and insurance companies are increasingly active in studying this principle and in trying to establish standards. Swartwout provides two products for "Escape" ventilation over factory rooms, auditorium stage areas, stair wells and vent shafts.

AIRMOVER, widely used large scale ventilation system, is effective for "Escape" ventilation when equipped with fusible link releases for dampers. Can be installed by single units or in continuous runs.

FIRE VALVE, for extreme heat release only, has two large dampers that drop when fuse melts, provides 46 sq. ft. of escape area per unit . . . Write for "Escape" Ventilation Bulletin 350-F.

18511 Euclid Avenue, Cleveland 12, Ohio
The Swartwout Co.
Roof Ventilators and Ventilating Louvers
POWER PLANT EQUIPMENT • PROCESS INDUSTRY CONTROLS

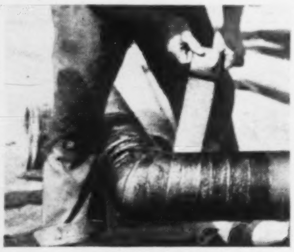
COMBAT CORROSION!

Specify

TAPECOAT®

. . . the Original Coal Tar Coating in Tape Form for Pipe, Pipe Joints, Couplings and Tanks

TAPECOAT is a coal tar coating with a tar-saturated close-woven fabric as a carrier for speed of application. The coal tar is self-bonding and requires no foreign adhesives.



Because coal tar is nature's own protection against corrosion, TAPECOAT resists moisture, acids, alkalis, soil stress, electrolysis, chemical fumes, fly ash, salt water, salt-laden air, barnacles, and other severe corrosive and abrasive conditions above and below ground.

TAPECOAT is clean to handle and easy to apply by spiral or "cigarette" wrapping with the use of a torch to bleed the coating to insure a continuous bond. It cuts maintenance and replacement costs.

TAPECOAT is sized to the job—comes in rolls of 2", 3", 4", 6", 18" and 24" widths to meet specific requirements on pipe, pipe joints, couplings, tanks, cable, conduit and other vulnerable steel surfaces.

PROVED IN SERVICE SINCE 1941

TAPECOAT has proved its dependability over the years in serving gas and oil companies, railroads, telephone companies, air lines, shipbuilders and operators, water and sewage works, chemical and industrial plants, engineers and contractors . . . providing continuing protection against corrosion.

Write for descriptive brochure and prices.

The TAPECOAT Company

Originators of Coal Tar Tape Protection

1555 Lyons Street, Evanston, Illinois

WHO'S WHAT

Continued

▶ *GIFFELS AND VALLET, INC.*, Detroit—Raymond F. Giffels, recipient of a special Centennial Award from Michigan State College for "outstanding contributions to society, for achieving distinction in his endeavors, and for setting the highest standards of accomplishment." Mr. Giffels, secretary-treasurer of Giffels and Vallet, is one of eight to receive the award this year.

▶ *ARCOS CORP.*—John K. Light, assistant sales manager; James A. Brickett, Jr., New England district sales manager, the post held by Mr. Light prior to his advancement.

▶ *BAILEY METER CO.*—Paul S. Dickey, president; Harvard H. Gorrie, vice president in charge of all engineering activities. Mr. Dickey succeeds Robert S. Coffin, who was elected chairman of the executive committee and named management consultant.

▶ *METAL & THERMIT CORP.*—Dr. J.E. Stareck, director of research; H.D. McLeese, general sales manager; George C. Betz, manager of sales, Chemical & Metals Dept.; John A. Peterson, Jr., appointed to the ceramic service staff; William C. Cuntz, assistant manager of sales, Welding Dept.

▶ *NATIONAL-U.S. RADIATOR CORP.*—Edward F. James, general office manager.

▶ *COMBUSTION ENGINEERING, INC.*—Donald S. Walker, a director. Mr. Walker is vice president and director of sales.

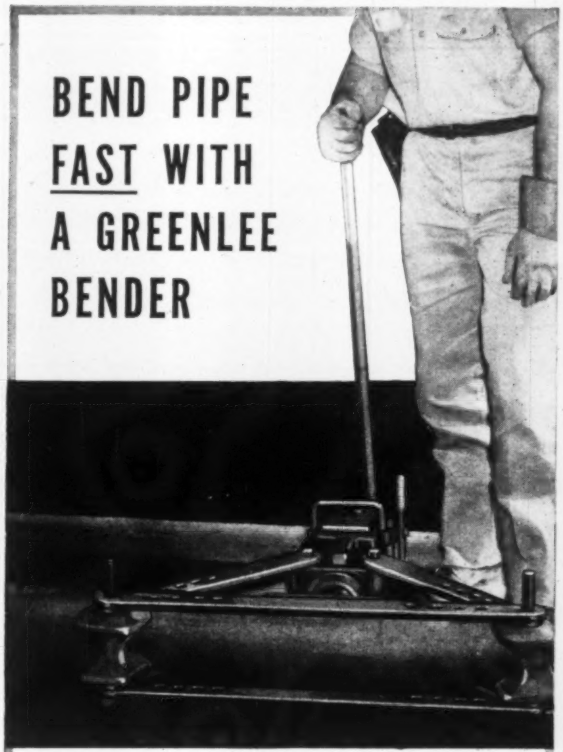
▶ *CONNOR ENGINEERING CORP.*—Walter L. Berdahl, advertising manager.

▶ *CLYDE TUBE FORGINGS OF AMERICA, INC.*—Jay S. Case, vice president in charge of production.

▶ *NATIONAL CYLINDER GAS CO.*—Walter H. Girdler, vice president; Harold W. Alenduff, treasurer. Mr. Girdler is a director of the company.

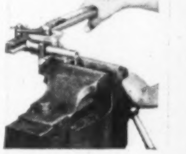
▶ *PHILADELPHIA GEAR WORKS, INC.*—S.L. Crawshaw, assistant to the president.

▶ *WOLVERINE TUBE, DIV. OF CALUMET & HECLA, INC.*—Dr. Donald Q. Kern, professional consultant in the field of heat transfer.



BEND PIPE FAST WITH A GREENLEE BENDER

Built for the tough jobs, the Greenlee Hydraulic Bender saves hours, cuts costs on your piping work . . . smoothly bends *all sizes of pipe up to 5"*. With the Greenlee, *one man* quickly makes accurate bends "right on the job" exactly where and when needed! Many owners report labor savings of 50% and more . . . and the cost of many manufactured bends and fittings is eliminated. Compact, portable, versatile . . . use the same power unit with radius attachments for making radiant heating return bends. Two models. Portable power pump also available to put your bending on a fast "production line" basis. Reduce costs, speed jobs with the Greenlee Bender, which often pays for itself on the very first job. Get facts today.



TUBING BENDERS Swiftly produce accurate small-radius bends in tubing and pipe. No flattening or kinks. Especially designed to form neat bends to fit sharp corners and nooks and other close quarters. Various sizes and models for pipe, steel, copper, brass and aluminum tubing.

TOOLS FOR CRAFTSMEN

GREENLEE

Greenlee timesaving tools for plumbing and heating work: Hydraulic Pipe Pushers • Hydraulic Pipe Benders • Tubing Benders • Pipe Bits Auger Bits • Spiral Screw Drivers • Chisels • And many more Greenlee Tool Co., 2347 Twelfth Street, Rockford, Illinois

SAVE TIME and MONEY when you form FLEXIBLE CONNECTORS

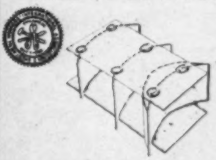
use
"engineer approved"

ELGEN SILENT DUCT

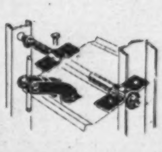
*Pats. Pend.

Imagine, this one-piece, factory-assembled metal-to-material unit unrolls absolutely *flat!* No more bothering with unwieldy duct material that buckles easily. Elgen Silent Duct makes on-the-spot work a cinch . . . you just measure and cut. You can fabricate *any type* of flexible duct connector in minutes . . . with half the effort! You can save up to 60%! No more worry about an inventory of "made-up" parts, either. Your choice of U.L. approved, (Gov't. Spec. Mil-D-10860) canvas, Johns-Manville asbestos and U. S. Rubber neoprene coated fibre glass, in 3" or 6" widths attached to 24 or 26 gauge galvanized steel or 24 gauge aluminum to fill every job requirement. All available in handy-to-use 25, 50 or 100 foot rolls.

2 More Elgen Products That Put Profits In Your Pocket!



ELGEN ALL-TITE VANE RUNNER
• Quickest and easiest way ever devised for installing turning vanes for square elbows • No special tools required; vanes lock easily with blow of hammer



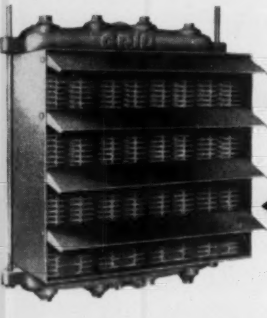
ELGEN DAMPERSET
For Multi-Blade Dampers . . . Parallel or Opposed • Most perfect damper hardware developed • Assembles in a jiffy . . . cuts assembly time in half • Easily adjusted and self-aligning. Licensed by Minneapolis-Honeywell

ELGEN PRODUCTS ARE SOLD THROUGH LEADING JOBBERS EVERYWHERE.

"Put Profits In Your Pocket!"

Write today for free catalog and "spec" sheet! Dept. E-6

ELGEN MANUFACTURING CORP. 41-34 39 Street, Long Island City, N. Y



hang 'em ...and forget 'em

GRID

UNIT HEATERS

Trouble-free heating service in the...

Nation's Leading Industries since 1929

...NO Maintenance or Repairs

The reason for this wide acceptance . . .

GRID'S All-Cast construction having similar metals in contact with steam prevents electrolytic corrosion.

GRID'S ability to withstand steam pressures up to 250± P.S.I.

GRID'S low outlet temperatures, proper fan sizes and motor speeds assure delivery of warm comfortable air in ample volume, directly to the spot where it is needed. Maintenance cost conscious management men turn to GRID for relief from the continuous expense of heating failures experienced with ordinary unit heaters. GRID Unit Heaters installed in 1929 are still operating today . . . the only attention needed has been an occasional oiling of the motor. No ordinary unit heater can approach this record.

- STEEL MILLS
  - United States Steel
  - Allegheny Ludlum
  - Inland Steel
  - Bethlehem Steel Corp
  - Carnegie Illinois Steel Co
  - Wheeling Steel Corp
  - Youngstown Sheet & Tube Co.
  - Armco Steel Co.
  - American Steel & Wire Co.
  - American Chain & Cable
  - Etc.
- PAPER PRODUCTS
  - Marathon Corp
  - Everett Pulp & Paper Co
  - West Virginia Pulp & Paper Co
  - Consolidated Water Power & Paper Co.
  - National Container
  - Celotex Corp.
  - Etc.
- CHEMICAL PLANTS
  - E. I. Du Pont Chemical Co.
  - Monsanto Chemical Co
  - Merck & Co., Inc
  - Allied Chemical & Dye Corp
  - Victor Chemical Works
  - Dow Chemical Co.
  - Etc.
- RAILROADS
  - New York Central
  - B & O R R
  - Great Northern
  - Canadian Pacific
  - Santa Fe
  - Chesapeake & Ohio
  - Chicago North Western
  - Pennsylvania
  - Illinois Central
  - Northern Pacific
  - Milwaukee Road
  - Etc.
- AUTOMOTIVE
  - Electric Auto Lite Co
  - General Motors
  - Ford
  - Kelsey Hayes Wheel
  - B. F. Goodrich
  - U.S. Rubber Co.
  - Goodyear
  - Etc.
- ELECTRICAL APPLIANCES
  - General Electric Co
  - Bendix Corp.
  - Louis Allis Co.
- FOOD PRODUCTS
  - Armour
  - Swift
  - General Foods Corp
  - Kraft Foods
  - Beatrice Foods
  - George A. Hormel Co.
  - Borden Co
  - Penick & Ford
  - Etc.
- MISCELLANEOUS
  - Johns-Manville
  - Minnesota Mining & Mfg Co.
  - International Harvester
  - Hercules Powder
  - Falk Corporation
  - Armstrong Cork
  - National Lead Company
  - Masonite
  - Standard Oil Co
  - Sinclair Refining Co.
  - Union Carbon & Carbide

Get the full story today. Ask for booklet
CORROSION IN UNIT HEATERS . . . it's yours upon request.

D. J. MURRAY MANUFACTURING CO.
Manufacturers Since 1883 • WAUSAU, WISCONSIN
REPRESENTATIVES IN ALL PRINCIPAL CITIES

WHO'S WHAT

Continued

▶ *WILLOW RUN RUBBER AND LINING CO.*—Edward H. Hindle, added to executive board and sales staff.

▶ *J. A. ZURN MFG. CO.*—Harry E. Goss, assistant to the president in charge of manufacturing, distribution and warehouse operations on the West Coast and other areas; John H. Schmid, research engineer in New York City.

▶ *COPPER & BRASS RESEARCH ASSN.*—Austin R. Zender, president. Mr. Zender is executive vice president of Bridgeport Brass Co., Bridgeport, Conn.

▶ *A. W. CASH CO.*—John A. Wiedmann, director of research and development.

▶ *DAYTON AUTOMATIC STOKER CO.*—Joseph F. Stenglein, executive vice president and general manager.

▶ *WESTINGHOUSE ELECTRIC CORP.*—E.W. Seay, assistant manager of general advertising.

▶ *R-P&C VALVE DIV., AMERICAN CHAIN & CABLE CO.*—John W. Swengel, assistant works manager.

▶ *AJAX FLEXIBLE COUPLING CO., INC.*—Wayne Belden, president; Charles W. Belden, vice president; Harley E. Northrop, treasurer; Robert G. Cady, secretary.

▶ *SALL MOUNTAIN CO.*—John W. Kellar, appointed to special account development in the sales department.

▶ *TYPHOON AIR CONDITIONING CO., INC.*—S. Byron Stone, advertising and sales promotion director.

▶ *UNITED STATES AIR CONDITIONING CORP.*—L.P. Hanson, administrative vice president; R.P. Kelley, general sales manager.

▶ *T.R. FINN & CO., INC.*—Arthur W.H. Towne, sales manager for the company's industrial division.

▶ *FARR CO.*—Cletus J. Oster, plant superintendent.

There are

21 BASIC INDUSTRIES

and

HENDRICK

Serves Them ALL!

That's right! Hendrick serves every one of the 21 basic industries designated by the U. S. Department of Commerce under its Standard Industrial Classification list. If you have a perforating problem and are not already familiar with Hendrick's facilities, we stand ready to serve you, too!

Whatever your needs be, if you wish to perforate metal, rubber, plastic or masonite for a screening, straining, decorative, display or acoustical application, Hendrick's long experience can be of real help. Join the long list of manufacturers who now derive untold assembling and selling benefits by using Hendrick Perforated Metal as a fabrication material. Call Hendrick today.

Hendrick
MANUFACTURING COMPANY

48 DUNDAFF ST., CARBONDALE, PA. • *Sales Offices in Principal Cities*
Perforated Metal • Perforated Metal Screens • Wedge-Slot Screens • Architectural Grilles • Mitco Open Steel Flooring • Shur-Site Treads • Armorgrids

---

One of three Goulds Fig. 3750 pumps circulating chilled water in air conditioning system in big color processing building of Eastman Kodak Company, Rochester, N. Y.

They help keep roses red and violets blue

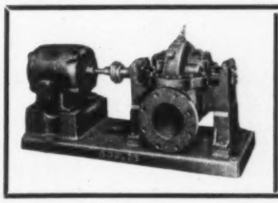
Processing color photographs requires extremely close control of temperature at all stages.

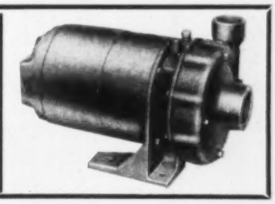
In the big color film and print processing building in Kodak Park, in Rochester, N. Y., three Goulds pumps like the one shown above help maintain the correct temperature by circulating 50° water through heat exchangers serving process work rooms.

The critical nature of the process means that these pumps must stay on the job 24 hours a day—day in and day out—and these Goulds pumps have been doing just that for the last two years.

You can insure the same kind of dependable pump performance in your air conditioning installations, too, by specifying Goulds pumps. There's a Goulds pump for every liquid handling job—designed from the experience gained over a century of pump manufacture, and ruggedly built to give long, trouble free service.

Your Goulds representative will be glad to help you select the right pumps to fit your requirements. If you prefer to write directly to our main office, your inquiry will receive prompt attention.





Goulds popular "close-cupld" Fig. 3642 and Fig. 3643 pumps provide compact efficiency, simplicity in small installations. In sizes from ¼ to 5 HP. Capacities up to 175 GPM, and heads to 140 ft. For additional details write for Bulletin 624-A.3.

Goulds Fig. 3405 double suction pump offers many advantages for larger installations. Available in 19 sizes, providing capacities up to 6,400 GPM, heads to 260 ft. For full details write for Bulletin 721.6.

MEMBER

Goulds PUMPS INC.
Seneca Falls
New York

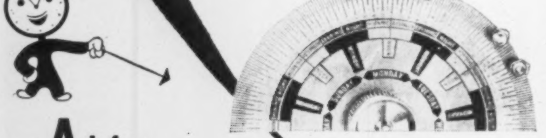
Atlanta • Boston • Chicago • Houston • New York • Philadelphia • Pittsburg • Tulsa

Cut customer fuel bills
7 days a week

it's good business to always install a PARAGON 700 Series Calendar Time Switch on commercial heating units

YES, the good word gets around fast when a Paragon 700 Series Time Switch is on the job cutting heating bills. Heat is *automatically turned off* when not needed. Customer satisfaction through lower fuel bills *plus* fewer service "call backs" are big profit boosters for you! Check these features: :

- **COMPLETELY FLEXIBLE** — completely economical. Switch settings can be made for the entire week's schedule, yet easily and quickly changed. ON-OFF or OFF-ON operation can be as close as 3 hours.
- **FULLY AUTOMATIC** — set it, then forget it. Saves money weekends, for example: switch may be set to cut off heat Saturday noon, then automatically start regular heating cycle earlier than usual Monday.
- **INSTANTLY CHANGEABLE** — simply set the dial trippers at desired day or night hours. Total of 14 are supplied as standard equipment.



Dial is graduated in hours and half-hours. Night and day periods clearly separated. Available in 24, 120 and 240 volts; 25, 50 and 60 cycles. No complicated wiring. Lists as low as $28.50.

Ask for Bulletin HP-5407
See your jobber, or write:
Dept. 1811

PARAGON ELECTRIC COMPANY
TWO RIVERS, WISCONSIN
World's Foremost Manufacturer of Time Controls

WHO'S WHAT

Continued

▶ *GATES ENGINEERING CO.*—John F. Ewert, Jr., director of advertising and sales promotion.

▶ *COMBUSTION ENGINEERING, INC.*—Theodore A. Dyke, vice president. He was formerly manager of the export division of the company's general sales department.

IN THE TERRITORIES . . .

(Recent sales appointments)

▶ *GENERAL FITTINGS CO.*—Greg J. Magratten, New York City sales representative for industrial heat exchanger products; Edmond Fain, representative for Virginia, North Carolina, Maryland, Washington, D. C.; Earl H. Neilson, a similar post covering Rhode Island, eastern Connecticut, southeastern Massachusetts.

▶ *C. G. HUSSEY & CO.*—John B. Turnbull, northern Ohio district manager.

▶ *JANITROL HEATING & AIR CONDITIONING DIV.*—R. Wayne Miller, representative for north central Ohio.

▶ *C. A. DUNHAM CO.*—James Guest, Toledo sales representative.

▶ *FEDDERS-QUIGAN CORP.*—John D. Daly, branch manager of new factory sales office in New York City; Griffith Distributing Co., distributor for the Indianapolis area; Harry H. Rowland, Florida district manager.

▶ *REFLECTAL CORP.*—Robert D. Sunshine, Southwest representative.

▶ *MINNEAPOLIS-HONEYWELL REGULATOR CO.*—New managers for field offices are: O.V. Spoustra, Hammond, Ind.; W.C. Waltman, Louisville; George Rossiter, South Bend.

Sales appointees and their branch offices: Charles L. Dozois, Tulsa; Jerome A. Hagen, Milwaukee; Charles R. Hartzog, New Orleans; Thomas B. Kendall and Raymond E. Sawyer, Los Angeles; David W. Kennedy, Baltimore; Hugh F. O'Hagan, Buffalo; James R. Pancake, Charleston; Jim E. Vermillion, Dallas.

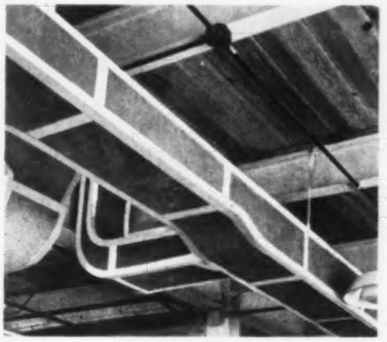
Field service engineers are: Anthony P. Alagero, Boston; Erhardt H. Baer, International Div., Germany; Clarence E. Bixby, Albany; George M. Chock-

COSTS MORE and WORTH IT!

Grant Wilson

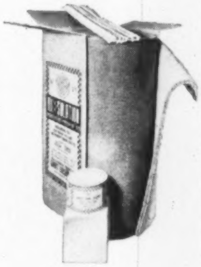
DUX-SULATION

ASBESTOS PROTECTED



Despite the advent of many lower priced insulations, many of the nation's leading architects and engineers continue to specify Grant Wilson Dux-Sulation. One reason is that Dux-Sulation is just about indestructible — can't possibly be crushed or cracked. Its insulation and sound absorption efficiency, high to start with, *cannot* be impaired during installation.

Dux-Sulation can't powder, shift or sift. There are no "thin" spots, even at corners. There is no deterioration of any kind, no change of any kind. Insulating values are constant, indefinitely!



Special adhesive and tape (supplied) obviate the need for any additional "fasteners". If desired, Dux-Sulation can be applied in the shop and still withstand all necessary handling. On all counts, especially on projects where nothing less than the best is acceptable, Dux-Sulation is still your logical choice — the insulation you can specify with *absolute confidence* . . . no ifs, ands or buts!

write for Bulletin 567H-7

Grant Wilson inc.

ASBESTOS and INSULATING MATERIALS

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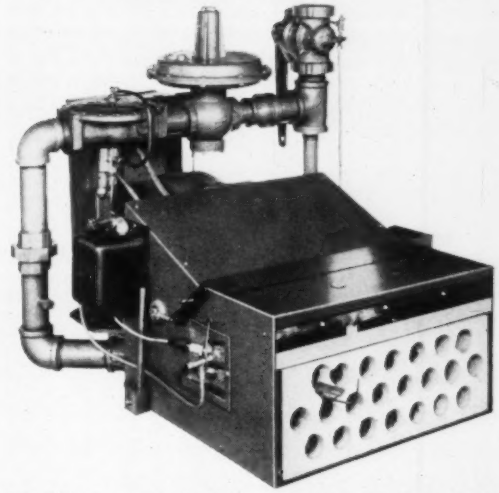
LO-BLAST

POWER-TYPE DUAL FUEL BURNER FOR GAS AND OIL!

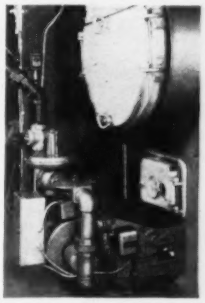


THE FINEST GAS BURNER...THE FINEST OIL BURNER ...NOW COMBINED IN ONE GREAT UNIT!

In this new burner, Lo-BLAST scores another genuine engineering achievement. All the features which have made the Lo-BLAST Power Gas Burner the recognized leader in gas burning efficiency are incorporated... plus an oil burner which sets a new standard for efficient oil combustion. This burner features a Laminar Flame which conforms to the characteristics of the gas flame, permitting a combustion chamber correct for either fuel.

Two models are available with maximum capacities of 1,250,000 and 2,500,000 BTU.

9 BIG FEATURES



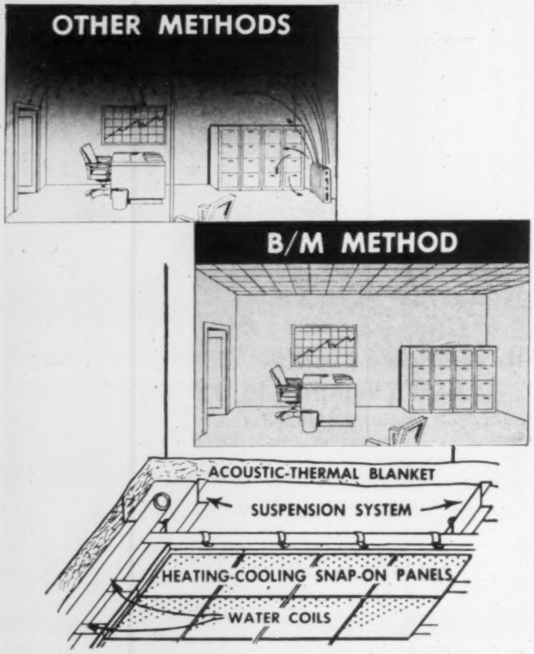
- **Highest efficiency on oil or gas . . .** Lo-BLAST design assures maximum fuel economy.
- **Laminar Flame Oil Burner . . .** Wide flat flame—no impingement on crown sheet or side walls.
- **Fits low base boilers . . .** Installs through average ashpit door.
- **Durable—reliable—safe . . .** Backed by 50 years experience. Factory tested. Underwriters' Laboratories approved.
- **Complete package . . .** Shipped assembled and wired—easy to install.
- **Manual or automatic fuel selector...** A damper transfers blower air to either gas or oil burner. Damper position governs switching action to controls.
- **Soft quiet flame...** *Low* pressure combustion air keeps both oil and gas flames quiet.
- **Safety purge cycle . . .** 30 second purge on each call for heat —also on fuel changeover.
- **No coking or clogging of oil nozzle...** Shield protects nozzle against reflected heat. Air cooled during gas cycle.

Send now for literature on this sensational new dual fuel burner

MID-CONTINENT
METAL PRODUCTS CO.
1960 N. Clybourn Ave., Chicago 14, Ill.

Let's face facts...

BURGESS-MANNING
RADIANT PANEL
Heating, Cooling
and Acoustic Control
is the modern comfort



The three functions of the Burgess-Manning 3-Way Radiant Panel Functional Ceiling are combined for the first time to provide uniform radiant panel heating or cooling with ideal room acoustics for a new standard of human comfort. This is verified by schools, hospitals, office buildings, laboratories and restaurants of recognition, designed and built by men of vision. The "Radiant Panel" Principle of this most modern ceiling provides constant, uniform heating and cooling independently of air movement. Heat energy is radiated to or from the entire ceiling, to or from every surface or object in the room. Convection drafts and heat shadows are minimized — concentrated heat sources and overheated air are eliminated. The word is getting around and your more discriminating clients will want the facts—do you have them?

Know the facts - Write for Bulletin A-129-H

Architectural Products Division of

BURGESS-MANNING COMPANY

5970 Northwest Highway, Chicago 31, Illinois

Manufacturers of 3-way Functional Ceilings
and Acousti-Booths for Telephoning

WHO'S WHAT *Continued*

ley, Charlotte; William G. Coffey, Hammond; Robert S. Dodds, Hartford; Paul N. Farnham and Donald P. Stearns, Syracuse; Harry A. Fuller and William R. Georg, Los Angeles; Robert L. Henrioud, Greenville; William R. Kelly, Witchita; Robert C. Knowlton, Cleveland.

Also: Jean Guy Leblanc, Montreal; George F. Lindquist, William F. Neuner and Charles F. Wohlmacher, New York; James C . Martin and Johnnie E. McLemore, Dallas; Ullie F. Merritt and Michael A. Sanchez, Houston; Philip M. Nelson, Dayton; William L. Newton, Kansas City; Fred G. Von Schwerin, International Div., Minneapolis; Harold T. Willis, Oklahoma City; Earl C. Witty, Chicago; Carl F. Zich, Buffalo.

▶ *WOLVERINE TUBE, DIV. OF CALUMET & HECLA, INC.*—J.H. Smith, as East Central district sales manager, transferred from Dayton to Detroit; R.B. Flynn, territorial supervisor in Dayton for the company's Columbus and Louisville offices; Jack Gavigan, replacing Mr. Flynn in Detroit; Jack Sheehan, replacing Mr. Gavigan in Louisville. The company has moved its greater Chicago sales offices to Evanston, headquarters for E.J. Campbell, Midwestern district sales manager.

▶ *ACME INDUSTRIES, INC.*—Henry Banks Edwards, southern regional sales manager.

▶ *A-P CONTROLS CORP.*—Vince Reynolds, sales representative in the company's Dallas area covering Texas, Oklahoma, Louisiana, Arizona.

▶ *SURFACE COMBUSTION CORP.*—William N. Fitzcharles, new representative for F.J. Evans Engineering Co., Surface Combustion's sales agent in Houston.

▶ *FAIRMONT ALUMINUM CO.*—New representatives responsible for technical advisory services and sales of aluminum coils, circles and sheets: C. L. Pursell, Michigan; George E. Sandberg Co., Minnesota, western Wisconsin.

▶ *TIWEL MFG. CORP.*—Tropicaire Engineering Co., direct factory representative in Florida.

▶ *DRAYER-HANSON, INC.*—Allied Refrigeration Suppliers, Inc., representative for part of southern California, Lower California, and Yuma, Ariz. and vicinity.

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Randall offers the most complete line of high quality Graphited Sleeve Bearing Pillow Blocks to be found anywhere. They are available in many different styles and sizes for light, normal, and heavy duty applications on shafts from ½" to 3$^{15}/_{16}$" inclusive. They have a reputation for giving long, quiet, trouble-free service with the minimum of maintenance. See this complete line of competitively priced pillow blocks at your local distributors, today.

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THRUST WASHERS
SAFETY COLLARS
BRONZE CASTING

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1012 S. Greenlawn Ave., Lima, Ohio

WHO'S WHAT

Continued

▸ *JOHNSON SERVICE CO.*—H. F. Abendroth, assistant manager of the company's Chicago branch.

▸ *PENN INDUSTRIAL INSTRUMENT DIV.*—William F. Braun, regional sales manager for the eastern United States.

▸ *PEERLESS ELECTRIC CO.*—Ray V. Norman, sales representative for the New England states.

▸ *J. F. PRITCHARD & CO. OF CALIFORNIA*—Factory Sales & Engineering, Inc., sales representative for southern Louisiana, southern Mississippi.

▸ *REVERE COPPER AND BRASS, INC.*—William F. Otto, manager of the company's New York district sales.

▸ *BELL & GOSSETT CO.*—Richard S. Dawson Co., southern California district representative.

▸ *B-I-F INDUSTRIES, INC.*—M. H. Strickland, manager of industrial sales, Chicago district.

▸ *WOLVERINE TUBE DIV. OF CALUMET & HECLA, INC.*—C. P. Whitlock, Philadelphia sales representative; William R. Morrisey, a similar post in Chicago and surrounding area.

▸ *CONNOR ENGINEERING CORP.*—Henry J. Couch, manager of the Chicago district office.

▸ *RESEARCH PRODUCTS CORP.*—Duane B. Becker, district sales manager for the company's air filter division for Wisconsin, Minnesota and the Dakotas.

▸ *SWARTWOUT CO.*—Whitney M. Kerr Co., representative for power plant and industrial ventilation equipment in Kansas and western Missouri.

▸ *BEAVER PIPE TOOLS, INC.*—Ned Dengler, district sales manager for southern Ohio, Indiana, West Virginia, Kentucky.

▸ *COOPER ALLOY FOUNDRY CO.*—John Wilfert Co., distributor serving New York, New Jersey and a considerable foreign market.

▸ *TRANE CO.*—I. Lamar King, named to new branch sales office in Tampa.

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"Sink" your heating problem in one easy stroke. Swing to National Champion Heaters. Whatever your heating need—space heating, tempering, make-up air, curing, drying or de-icing—there's a National Champion to do the job. Check these winning points:

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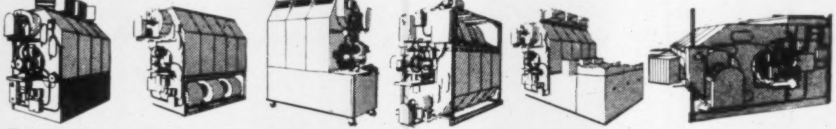
NATIONAL CHAMPION HEATERS—6 Models — 66 Sizes



Model H—vertical unit with discharge heads. 12 sizes.

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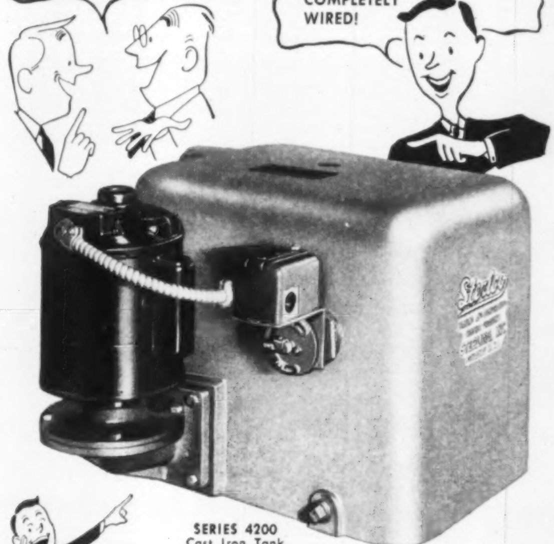
CONDENSATE PUMPS

HAVE THE WHOLE TRADE TALKING!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Cast Iron Tank

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EASY TO SELL
ATTRACTIVE TO DISPLAY

REALLY COMPACT, TOO! TAKES UP ONLY 2¾ SQ. FT. OF FLOOR SPACE

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Sterlco Condensate Pumps are ruggedly built, dependable, and simple to install and maintain. Only two sizes required to take care of jobs up to 15,000 sq. ft. E.D.R. — and up to 20 lbs. discharge pressure.

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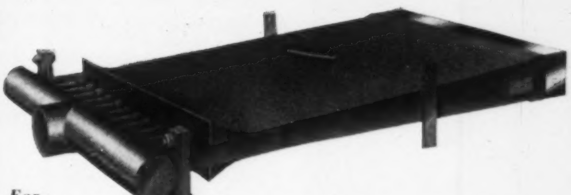
TEMPERATURE CONTROLS



For Intermediate and High Pressure Gas

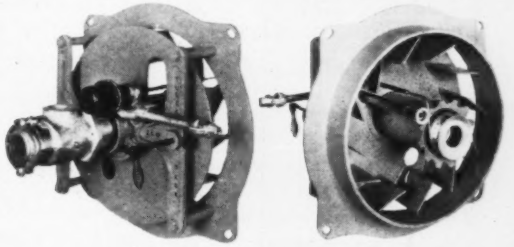
WEBSTER *RECTILINEAR Gas Burner

Now available after almost three years of operating tests and installations having capacity of 1,242,000,000 Btu/hr. at 10 psig.

This unique application of the *Venturi* principle has resulted in a high input burner that can be installed through *very* narrow rectangular furnace openings.

It is recommended for inter-tube firing; firing in a horizontal plane through small openings over coal grates; firing in a vertical plane on either side or on a horizontal plane over a stoker or oil burner; and also for use in all types drying kilns.

It is small in size, and light in weight, with excellent turn-down without flash back; stable flame retention even at high inputs—low noise level.



WEBSTER SERIES "R" Gas Burner

For High Pressure Gas with Combination Oil

When high pressure gas is available the 5 sizes of Series R Burners provide inputs from 2,000,000 Btu/hr/burner at 1 psi to 50,000,000 Btu/hr/burner at 10 psi.

There are practically no limits to the possible uses of the Series R assemblies except those imposed by the gas pressure available. It is most widely applied to high pressure boilers of 100 hp and above, steam generators of all types and refinery furnaces.

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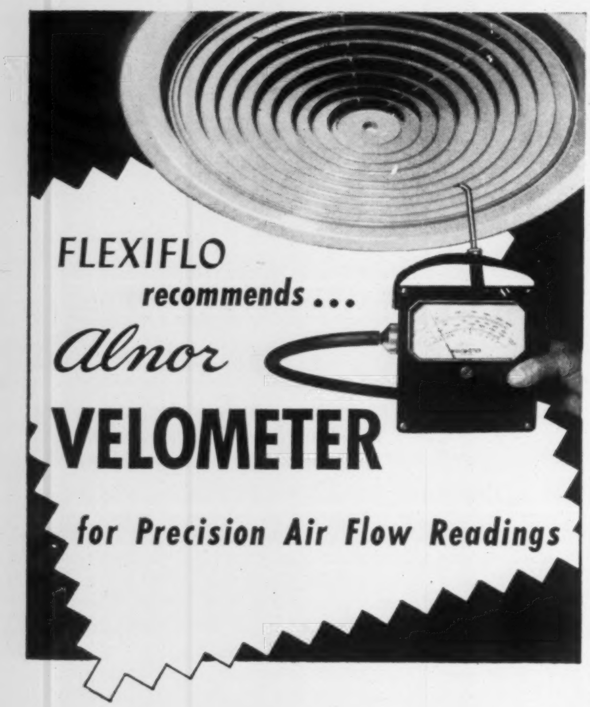
The WEBSTER ENGINEERING COMPANY
TULSA, OKLAHOMA
Division of SURFACE COMBUSTION CORPORATION, Toledo, Ohio



Experience has taught the Universal Diffuser Corporation that the Alnor Velometer minimizes time required to balance an installation of Flexiflo diffusers. They *recommend* the Alnor Velometer because they know it consistently measures *actual* air flow precisely and quickly.

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Company...
Address...
City...................................Zone......State..........

WHO'S WHAT

Continued

▶ *WORTHINGTON CORP.*—William J. Davies, district manager of Cleveland office, replacing Robert J. Laidlaw, retiring due to ill health.

▶ *BRYANT HEATER DIV. AIR DRYER SALES*—Slye Supply Co., Pittsfield, Mass. area; Bert Slater, Buffalo territory.

▶ *BUSH MFG. CO.*—Carl H. Willhoft, sales engineer covering San Francisco, northern California, Nevada.

▶ *WESTINGHOUSE ELECTRIC CORP.*—Gierke-Robinson Co., distributor for Westinghouse's Sturtevant Div. in Davenport, Ia.; Mills and Lupton Supply Co., a similar distributorship for Chattanooga and environs.

▶ *UNITED STATES AIR CONDITIONING CORP.*—James H. Montgomery, Midwest regional sales manager; Shaw-Gunter Refrigeration & Air Conditioning Co., distributor for south Georgia.

▶ *BRUNNER MFG. CO.*—Charles F. Cox, district sales manager of the company's south central territory.

▶ *UNION ASBESTOS & RUBBER CO.*—Kleinman Bros., Inc., distributor for air conditioning products in the Baltimore area.

▶ *YOUNGSTOWN SHEET AND TUBE CO.*—Richard J. Stamberger, assistant New York district sales manager.

▶ *GENERAL ELECTRIC CO.*—Wholesale distributors and retail dealers and their territories are: South Bend Electric Co., Inc., parts of Michigan, Indiana, Illinois, Missouri; Florida General Supply Corp., Miami area; Automatic Heating Supply, Inc., Illinois, Missouri; Seither & Cherry, Inc., counties in Iowa, Illinois, Missouri; F.B. Gardner Co., New Mexico.

▶ *RELIANCE ELECTRIC & ENGINEERING CO.*—Norman T. Greiner, appointed to sales engineering staff in Detroit.

▶ *MARLO COIL CO.*—Bob Carow, representative in west Texas

▶ *SPANG-CHALFANT DIV., NATIONAL SUPPLY CO.*,—David A. Hess, transferred to New York district office.

WIREMOLD AIR DUCT has unlimited flexibility

- Takes sharp bends without kinking
- Lightweight but sturdily constructed
- Greatly reduces installation time
- Air tight and flame resistant

Wiremold Flexible Air Duct was developed to meet the requirements for connections between branch ducts and air diffusers on high and low velocity commercial air conditioning systems. Its exclusive construction and specially coated Fibreglas fabric assure long life. Fabric component is *mechanically locked* into the strong, steel spiral . . . no glue or adhesive to dry out or crack, and accidental punctures can easily be sealed.

Air Duct provides practical flexibility to planning and layout. Exact positioning of outlets and connections is not essential. It's the ideal solution to ducting problems in cramped quarters, and for systems where every connection is at a different angle. One man can make a connection with this lightweight, flexible material, which snakes easily around structural members, saves time and money on installation. As the final complement to modular acoustical ceilings, Wiremold Air Duct permits relocation of diffusers without moving permanent duct work, so that air distribution for entire areas can be rearranged easily and quickly.

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Savings from only 2 Paid for All 85

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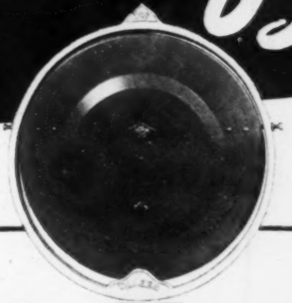

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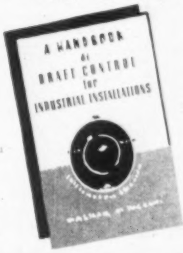
"BB" Industrial Draft Controls

In the Fairmac Corporation Housing Development near Washington, D.C., replacement of existing "controls" with Walker "BB" Draft Regulators reduced fuel consumption in two boiler houses to such an extent that the cash savings actually paid for complete installation of all 85 Walker draft units! These fuel savings were accomplished in only *three months time*—and they were so spectacular that the April, 1953 issue of *Fueloil & Oilheat* devoted its lead article to a report of the complete details of the story! Reprints of this article are available upon request.

Walker "BB" Industrial Draft Controls can bring you the same kind of savings that the Fairmac Corporation is enjoying. Find out how by reading Walker's "Handbook of Draft Control for Industrial Installations." It gives the most complete facts ever assembled on control selection, proper location, capacities, installation and adjustment. This valuable handbook is absolutely free — and your request for a copy puts you under no obligation. Reserve your copy now—just send coupon below to:



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Gentlemen: I want the complete story on how Walker "BB" Industrial Draft Controls can cut my fuel costs. Please send me your free handbook on "Draft Control for Industrial Installations." I'm considering draft control installations on:

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Store ☐
Factory ☐
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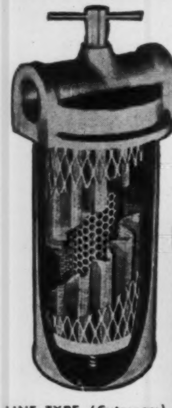
Other ____________

WATER FILTERS

All of the outstanding qualities that have made MARVEL SYNCLINAL FILTERS the overwhelming choice in the filtration of hydraulic oils and other oil base liquids have been adapted to provide the same efficiency in the filtration of water.

Balanced Synclinal Design means longer periods of efficient filtration and productive operation.



LINE TYPE (Cutaway)
IMMEDIATE DELIVERY!

Marvel not only delivers a top grade filter in both quality and performance, but DELIVERS IMMEDIATELY. If desired, shipments are made on same day orders are received.

SUMP TYPE
(Cutaway)

STURDY CONSTRUCTION

to withstand use under rugged conditions, yet simple enough to allow any workman to easily disassemble, clean and reassemble on the spot, in a matter of minutes.

A SIZE FOR EVERY NEED

Available in line and sump type units in capacities from 5 to 100 G.P.M Permanent type Monel metal insert ranging in mesh sizes from coarse 30 to fine 200.

Complete data and further information are contained in WATER CATALOG #300.

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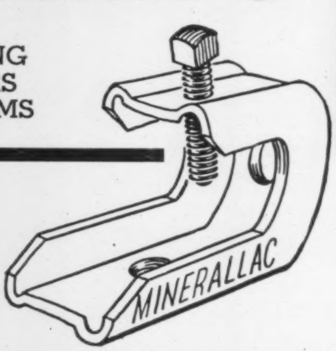
MINERALLAC
BEAM CLAMPS
FOR MOUNTING HANGERS ON I-BEAMS



Mounts Minerallac hangers No. 0 to No. 6 on I-Beams safely without necessity of drilling holes. Made of heavy gauge zinc plated steel with deep drawn ribs to give needed strength, these durable, light weight beam clamps have 1/4-20 tapped holes—will fit beam flanges up to 1/2 inch thick. Furnished with case-hardened set screw. Low cost.

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25 North Peoria St. Chicago 7, Ill.
MINERALLAC

WHO'S WHAT

Continued

▶ *PITTSBURGH CORNING CORP.*—George O. Otis, representative for Minnesota, Wisconsin, North and South Dakota, Iowa; James G. Archibald, attached to Kansas City sales office.

▶ *RICHMOND RADIATOR CO.*—William P. Weber, sales representative in metropolitan New York.

▶ *GENERAL CONTROLS CO.*—Otto Liepin, regional refrigeration representative for New England, New York, Philadelphia, Baltimore; William J. Daragh, manager of New England district office; Richard W.C. Barr, manager of Boston branch.

▶ *WHEELCO INSTRUMENTS DIV., BARBER-COLMAN CO.*—Personnel transfers are: Thomas H. Beggin, from Indianapolis to Cleveland; Robert N. Miller, Chicago to Los Angeles; Francis H. Beaupre, Toronto to Chicago; Howard P. Berger, Cleveland to Detroit.

▶ *CLEAVER-BROOKS CO.*—Powell Equipment Co., manufacturers' representative for boilers and equipment in Houston area; Dykes Co., representative for northern Louisiana, northeast Texas, southwest Arkansas.

▶ *BROWNELL ASSOCIATES, INC.*—B.S. Williams, appointed vice president and general sales manager. Brownell is the exclusive distributor in the northeastern U.S. for heat transfer products manufactured by Refrigeration Appliances, Inc.

▶ *AIRTEMP DIV., CHRYSLER CORP.*—Mutual Mfg. and Supply Co., wholesale distributor for southern Ohio, northern Kentucky, southeastern Indiana; Joe E. Fox of Central Distributors, Nashville, director of wholesale distribution in middle Tennessee.

▶ *DAVIS ENGINEERING CORP.*—Les Tye Co., upper Texas east of New Mexico, Shreveport; Harlan Engineering Co. extreme western Texas, southern half of New Mexico; Dravo Corp., Midwest territories covered by its Pittsburgh, Cleveland and Detroit offices, Robert Warnock Co., Alabama, western Florida, eastern Mississippi.

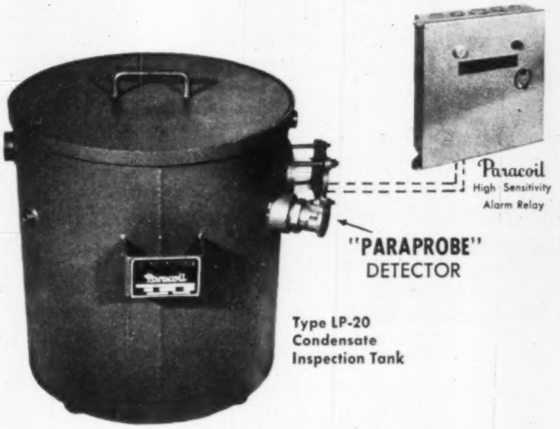
▶ *WESTINGHOUSE ELECTRIC CORP.*—Strong, Carlisle & Hammond Co., distributor for industrial fans, ventilating sets, unit heaters in the northern half of Ohio; Hahnel Bros. Co. and Bangor Roofing Co., distributors for same in Maine.

IT'S NEW!

Paracoil OIL-LEAK DETECTION SYSTEM

for

STEAM TYPE FUEL OIL HEATERS

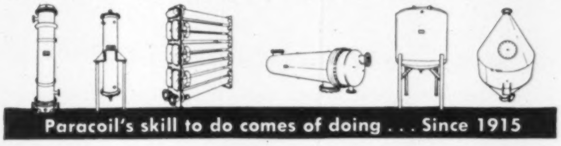


Continuously Monitors the Purity of Condensate leaving Steam-Type Fuel Oil Heaters

- Isolates all fuel oil entrained in the condensate stream
- Gives alarm to plant Personnel
- Protects the boiler by removing oil contamination from feed-water cycle
- Applicable to both low and high pressure steam plants
- Engineered to the special requirements of each installation

Write for further details

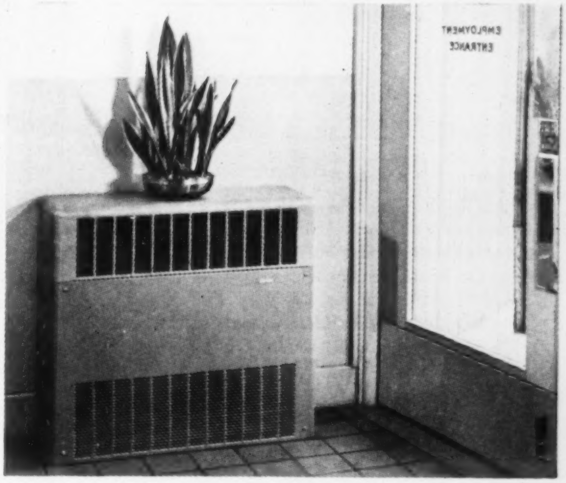
DAVIS ENGINEERING
CORPORATION
30 Rockefeller Plaza, New York 20, N. Y. 1064 E. Grand Street, Elizabeth 4, N. J.



Paracoil's skill to do comes of doing . . . Since 1915

Carrier knows heating

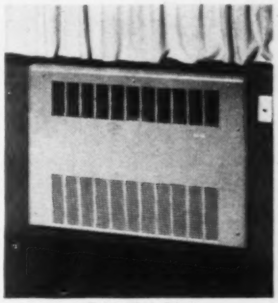
Over fifty years of leadership in air conditioning have given Carrier unmatched experience in the control of temperature—heating as well as cooling. Yes, Carrier knows heating by experience . . . and all this engineering skill and leadership contributes to the superiority of Carrier Unit Heaters.



CARRIER CABINET UNIT HEATERS

Cold reception rooms, lobbies, vestibules, entrances are poor invitations to patrons of banks, hotels, stores, restaurants or similar commercial establishments. Owners will never know how much business they lose as a result. But the cost of a Carrier Cabinet Unit Heater is so little in comparison that the installation becomes a matter of good business.

Carrier floor, ceiling and semi-recessed wall models are suitable for both steam and hot water. Every unit has many unmatched features such as quiet blower assembly, directional air louvers, long-lasting non-ferrous tubes and fins, functional design for easy installation, and attractive styling and finish.



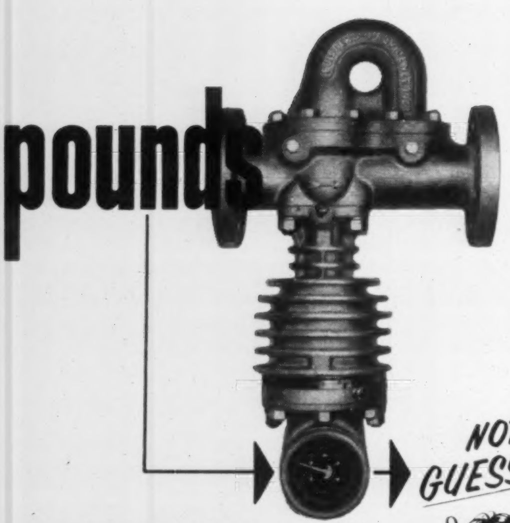
Recessed model

WRITE OR MAIL COUPON for model sizes, feature story and selection data

Carrier

air conditioning
refrigeration
industrial heating

CARRIER CORPORATION
305 S. Geddes St., Syracuse, New York
Send folder on Carrier Cabinet Unit Heaters.
Name ______________________
Business ______________________
Address ______________________



Install BUILDERS SHUNTFLO STEAM METERS right in your steam lines. Keep track of steam costs by seeing where steam is going and how much. Shuntflo Meters available in Model SMKS (shown) for 2" to 14" lines — Model SMDH for 1" and 1½" lines. **Write for Shuntflo Bulletins. Builders-Providence, Inc. (Division of B-I-F Industries, Inc.), 381 Harris Ave., Providence 1, R. I.**

BUILDERS-PROVIDENCE
DIVISION OF B-I-F INDUSTRIES, INC.
METERS FEEDERS CONTROLS

G&O COILS
for
HEATING and COOLING

G&O RADIATION

A full line of sizes now available to meet all industrial requirements. Send for catalog.

THE G&O MANUFACTURING COMPANY
New Haven 8, Connecticut
Pioneer Manufacturers of Square Finned Tubing in the United States

WE HEAR THAT . . .

▶ Plans are underway to merge the operations of *PERFECTION INDUSTRIES, INC.* and *HUPP CORP.* Hupp has purchased 65,000 shares of Perfection's common stock. Another 45,000 shares were acquired by Hupp associates in New York, *JOHN O. EKBLOM & CO.* and *DAVID J. GREENE & CO.* The 110,000 shares represents about 40 percent of Perfection's common stock.

▶ *NORTHERN STATES POWER CO., MINNEAPOLIS-HONEYWELL REGULATOR CO.* and *GENERAL MILLS, INC.* have entered into a joint undertaking in the atomic energy field. To be known as the *MINNESOTA NUCLEAR OPERATIONS GROUP*, the assemblage plans "to evaluate and further nuclear developments of interest to the state and its industries."

▶ Use of *YARDLEY PLASTICS CO.'s* plastic pipe and fittings for air conditioning cold water applications is being authorized by some municipal building inspectors, the company reports. The first cities to give approval are Columbus and Baltimore.

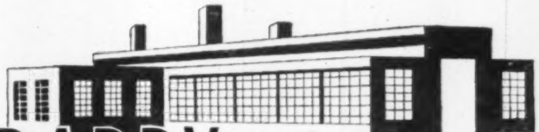
▶ Anthracite producer *GLEN ALDEN CORP.* is diversifying into other businesses with the $11 million purchase of *MATHES CO.*, Fort Worth, manufacturer of heat pumps, air conditioners and fans.

▶ *OWENS-CORNING FIBERGLAS CORP.* is holding a clinic designed to keep the company's field industrial sales specialists abreast of the latest developments in methods of application, insulation engineering, cold storage construction, new products and improvement of existing products.

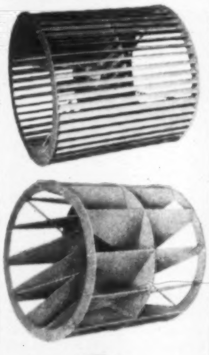
▶ *R. J. ABRAMSON & ASSOCIATES* has changed the firm name to *R. J. ABRAMSON & J. M. KLIPP* and moved to larger quarters at 537 S. Dearborn St., Chicago.

▶ New and expanded testing and technical information services offered industry following completion of new research laboratories are described in an anniversary issue of *Eutectic Welding News*, available from *EUTECTIC WELDING ALLOYS CORP.*

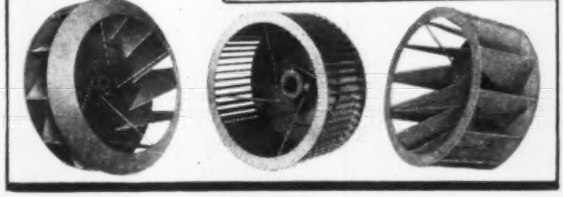
▶ A new 100,000 sq ft warehouse has been put into service by the *EMERSON ELECTRIC MFG. CO.*, St. Louis. The steel and concrete structure, located next to the main Emerson plant, was dedicated recently in ceremonies conducted by *W. R. PERSONS*, company president.

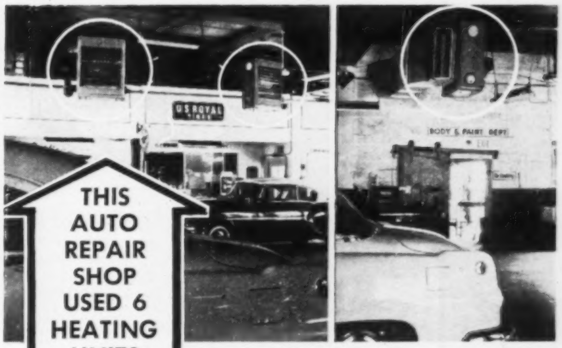


BARRY *Industrial* **BLOWER WHEELS**



Built to your specifications. All types heavy duty wheels — single inlet, double inlet, forwardly curved, and backwardly curved — all sizes 6″ to 72″ diameter. Welded or riveted construction. Prompt deliveries. BARRY blower wheels are precision built, expertly trued, and perfectly balanced by specialists for long, smooth service. Send specifications for quotation, performance data, etc. to BARRY BLOWER CO., 3112 California St. N. E., Minneapolis 18, Minnesota.





THIS AUTO REPAIR SHOP USED 6 HEATING UNITS . . . *until* 3 *Delta* OIL UNIT HEATERS *took over!*

Send for complete new catalog

PROBLEM: The 6 old-fashioned heaters in this Pontiac agency and repair shop were expensive to operate and required costly repairs quite often.

SOLUTION: 3 Delta oil-fired unit heaters replaced them. Installation was easy and cost surprisingly little because they required no boilers, pipes, fittings, valves, etc. They're factory wired and completely assembled . . . all ready to hang up.

RESULTS: The building was comfortable throughout the winter; no maintenance was required and operating costs were reduced 60%.

This is only one of hundreds of jobs that a Delta OIL Unit Heater can do better and more economically.

DELTA HEATING CORPORATION
TRENTON 8, NEW JERSEY

AUTOMATIC D HEATING

VIBRATION PROBLEM?

Engineers specify PACKLESS Vibration Absorbers when excessive compressor line movement is encountered. Available to fit ¼″ O.D. to 10⅛″ O.D. copper tubing.

Write for Bulletin VA-3

PACKLESS
METAL HOSE INC.

31-12 WINTHROP AVE., NEW ROCHELLE, N. Y.

for

SPECIFICATION

and **BUYING**

INFORMATION

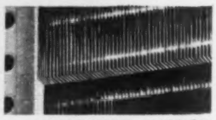
Use your complete, up-to-date

JANUARY DIRECTORY ISSUE

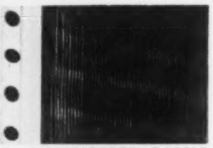
Your job will be a lot easier if you'll keep the January Directory issue of Heating, Piping & Air Conditioning constantly available for handy reference. It's one of your most valuable tools — one which will save you many hours of looking up the products you need for your various jobs. It's the ONE complete, up-to-date, readily accessible source of product information on who makes the pumps, valves, traps, compressors, specialties of all kinds, etc., you need — and where they're located. They're identified by trade names, too. EVERY product is listed, alphabetically arranged and printed on a distinctive yellow stock for easy reading and reference. Keep it handy . . . it's a time saver.

THE ONLY AIR-COOLED CONDENSER WITH THESE 2 ESSENTIAL FEATURES

REMPE
"Atmos-Therm"®



1. **DESUPERHEAT SECTION** Special large volume gas inset section. Hot gas from compressor expands slightly to accelerate its transfer from a dry gas to a wet vapor. Completion of change is made in smaller tubes.



2. **AIR BLEEDER BAFFLE** Allows stream of air to be directed over all return bends for maximum efficiency. Return Bend Cover Plate perforated to allow measured amount of air to be directed over bends and headers.

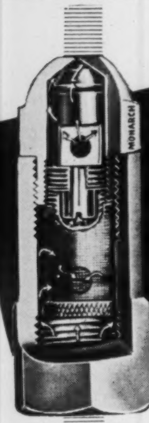
THE REMPE "ATMOS-THERM"

- Completely eliminates the need for condenser water.
- Minimizes operating and service expense.
- Eliminates water supply and disposal cost.
- Is adaptable to inside or outdoor installation.
- Outlasts cooling towers and evaporative condensers.

Write for details and price.

HEAT TRANSFER EQUIPMENT REMPE CO. Founded 1890

REMPE COMPANY
342 N. Sacramento Blvd. Chicago 12, Illinois



Monarch NOZZLES For HUMIDIFYING

Monarch Brass F-80 Air Conditioning Nozzles (or ¼" male one-piece H-261 style) produce the finest possible breakup of small capacities with low direct pressure only. No air required.

The most popular size is #3.00 which operates on as little as 25 pounds pressure, delivers 1.00 gph and produces a very wide angle of spray (120°) in a fine, soft, fog-like mist.

Available in 25 different capacity sizes from .57 gph upwards, all Brass construction with 120 mesh Monel screen strainers.

WRITE FOR CATALOG 6-A

Monarch MFG. WORKS, INC.
2523 E. ONTARIO ST.
PHILADELPHIA 34, PA.

Canadian Agents: (Except B.C.)
Canadian General Filters Ltd., Toronto 16, Canada

WE HEAR THAT

Continued

▶ A $1,600,000 expansion program to result in construction of a new fabricating and office building has been authorized by the board of directors of *LAU BLOWER CO.*, according to *HAROLD W. FAULKENDER*, president. The building will be added to the present Dayton plant and will increase office space by 20,000 sq ft and factory area by 15,000 sq ft.

▶ Top executives of *FAIRBANKS CO.* recently presented *C. E. THYNG*, the company's New England sales manager, with a replica of the Joseph Conyer Bowl to celebrate his 50th anniversary of service to the company.

▶ *AMERICAN RADIATOR & STANDARD SANITARY CORP.* has established an atomic energy division to coordinate all company activities in that field. Division headquarters will be in Redwood City, Calif., where the company has one of its research laboratories.

▶ *DE LAVAL STEAM TURBINE CO.* has announced plans for a long range expansion program. Under this program land has been purchased for future construction of new buildings anticipated in Trenton and Houston. Building plans are already underway on sites near Chicago and San Francisco.

▶ *METROTYPE CORP.*, Summit, Ill., has been purchased by *HAYS CORP. GEORGE FOSTER* will continue as Metrotype president and also becomes a member of the Hays board of directors. Manufacturing operations of the two companies will stay separate.

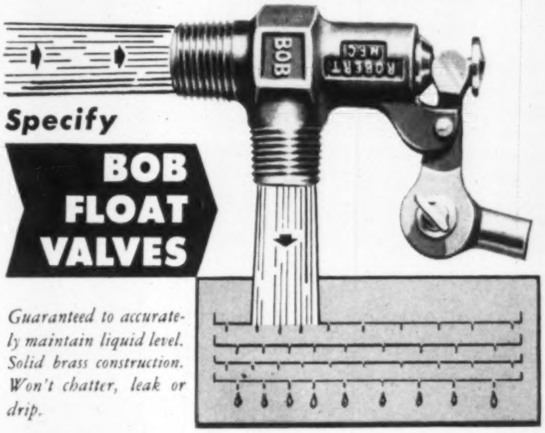
▶ Finding more efficient equipment to harness heat energy from all sources is the goal of continuing research at the Alliance, Ohio, Research Center of *BABCOCK & WILCOX CO.*, the company announces.

▶ Research engineers of *LUNKENHEIMER CO.* have designed and constructed a special wear test machine to reproduce 20 years of actual service mechanically to allow study of materials, parts and design of the company's all-molded plastic valve.

▶ Work is scheduled to get underway on *YOUNGSTOWN SHEET AND TUBE CO.'s* new seamless tube mill at its Indiana Harbor Works in the Chicago district.

▶ *U.S. ELECTRICAL MOTORS, INC.* has announced plans for the erection of 63,000 sq ft of additional manufacturing space at its Milford, Conn. plant.

The Standard Valve
For COOLING TOWER applications . . .



Specify

BOB FLOAT VALVES

Guaranteed to accurately maintain liquid level. Solid brass construction. Won't chatter, leak or drip.

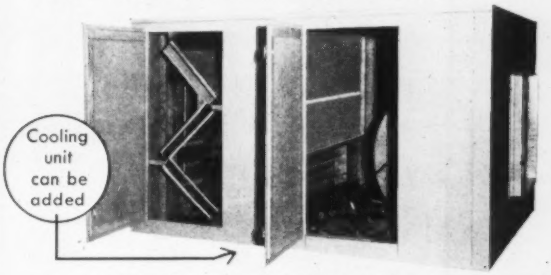
Standard equipment for Major COOLING TOWER manufacturers and piping fabricators for POSITIVE-ACTION and unsurpassed performance under the toughest service conditions. Take advantage of the savings thru standardization —*one source for completeness of line—smaller and more flexible inventory—preventive maintenance—safety—durability—interchangeability—increase of sales—customer satisfaction and* ECONOMY.

Competitively priced and available in sizes from ⅜" to 1½". Write for details of complete line.

ROBERT Manufacturing Company
9035 Venice Boulevard, Los Angeles 34, California

The new
KLIMATIC KING

a compact heating, ventilating unit
Ideal for applications where high humidity is a problem



Designed for dairy, food processing and industrial plants. The Klimatic King is fabricated with a corrosion-resistant galvanized steel casing, insulated to eliminate condensation and dripping. Automatic controls for temperature and ventilation. Two speed motor for "high" and "low" production periods, provides maximum economy of operation. These and many other features are standard with the Klimatic King, not "optional extras". The quality leader in its field. Sizes 3,500 to 20,000 CFM.

Architect and dealer inquiries invited. More than fifty years experience is at your disposal. Write today

THE King CO. OF OWATONNA
NORTH WINONA ST. OWATONNA, MINNESOTA
MANUFACTURERS OF SHARP FREEZE, COOLING, VENTILATING AND HEATING SYSTEMS

PHOENIX DROP-FORGED FLANGES

. . . and Water Heater Adapters

Precision made . . . well-machined . . .
individually inspected . . .
meet underwriters' specifications.

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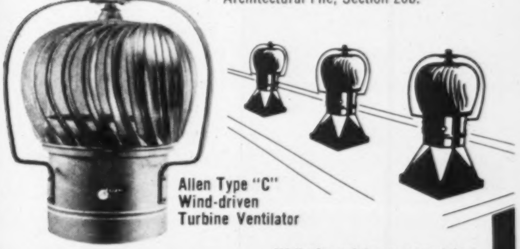
FLANGE DIVISION
PHOENIX MANUFACTURING CO.
CATASAUQUA, PA. • JOLIET, ILL.

FOR TOP PERFORMANCE . . .

SPECIFY Allen

TURBINE VENTILATORS

Accurately rated, wind-driven Allen Turbine Ventilators are doing a noteworthy air-displacing job on commercial and industrial rooftops all over the country. Ruggedly built of prime sheets of heavy-gauge coated iron, (special, non-ferrous metals also available), these almost noiseless ventilators are in stock, ready for immediate delivery to you. Throat diameters, 6 to 48 inches. Economical to install and maintain, Allen Turbine Ventilators give maximum performance per dollar spent. Another type, motor-equipped Electro-Wind Turbine Ventilator, is available for use in areas where wind velocities are not always sufficient. Engineering assistance gladly furnished. Our representatives are in most principal cities; names listed in our catalog in Sweet's Architectural File, Section 20b.



Allen Type "C" Wind-driven Turbine Ventilator

Write for catalog on complete line of roof ventilators.

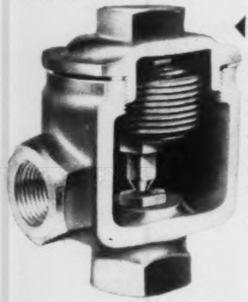
ALLEN ENGINEERED VENTILATION

ALLEN COOLER & VENTILATOR INC.
ROCHESTER, MICH.
Roof Ventilators for Every Commercial and Industrial Need

Have you information on these popular STERLING items?

LIFTING AND VACUUM PUMPING MACHINES

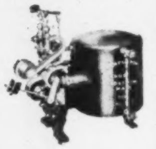
A simple but effective method for handling hot returns at any temperature. Noiseless operation. May be had with receivers.



THERMOSTATIC TRAPS

STERLING traps are made of bronze in ½" and ¾" size, for pressures from 0# to 200#, and with a full effective area of a large orifice for air removal. Should repairs ever be necessary the bellows is easily removed with a conventional ⅝" hex wrench . . . . no special spanner is needed!

TEMPLETON BROTHERS MODEL



CAPACITY

An important fact to remember when buying steam traps, is that traps are purchased to handle HOT condensation and should be bought for CAPACITY and not by pipe size. Avoid trouble by purchasing them on a CAPACITY basis as you do your boilers, engines, motors, etc.

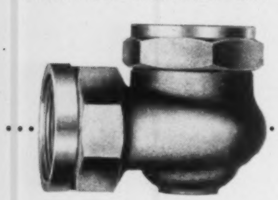
Write us for literature.

STERLING ENGRG. & MFG. CORP.

114 BUSINESS STREET, HYDE PARK 36, BOSTON, MASS.

SPRAYING SYSTEMS CO.

for lower cost



and better performance

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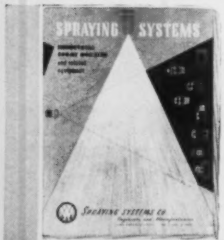
Modern design. Precision machining. All materials. Thousands of standard industrial spray nozzle types and sizes to choose from. Years of proved experience at your service.



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Ask for our new 48 page Catalog No. 24 . . . the most comprehensive spray nozzle catalog ever produced. Yours for the asking.

SPRAYING SYSTEMS CO.

3219 Randolph Street • Bellwood, Illinois

MEETINGS & CONVENTIONS

JULY 12-14—*Western Plant Maintenance Show.* Pan Pacific Auditorium, Los Angeles. Management: Clapp & Poliak, Inc., 341 Madison Ave., New York 17.

SEPT. 12-16—*Instrument Society of America,* 10th annual conference and exhibit. Shrine Exposition Hall and Shrine Auditorium, Los Angeles. Show office: 3443 S. Hill St., Los Angeles 7.

OCT. 27-28—*National Conference on Industrial Hydraulics,* 11th annual meeting. La Salle Hotel, Chicago. Sponsored by Illinois Institute of Technology and Armour Research Foundation, 35 W. 33rd St., Chicago 16.

NOV. 1-5—*World Symposium on Applied Solar Energy.* Westward Ho Hotel, Phoenix. Subjects to be discussed are space heating and cooling with solar energy, solar water heaters, mechanical energy from solar energy, direct conversion of solar energy and others. Symposium is cosponsored by the Association for Applied Solar Energy and Stanford Research Institute, Stanford, Calif.

NOV. 14-17—*2nd International Automation Exposition.* Navy Pier, Chicago. Exposition headquarters is at 845 Ridge Ave., Pittsburgh 12.

NOV. 14-18—*Chicago Exposition of Power & Mechanical Engineering.* Coliseum, Chicago. The exposition is being held in conjunction with the 75th Anniversary Meeting of the American Society of Mechanical Engineers. Management: International Exposition Co., Inc., 480 Lexington Ave., New York 17.

NOV. 28-*DEC.* 1—*9th Exposition of the Air Conditioning and Refrigeration Industry.* Convention Hall. Atlantic City. The exposition is sponsored by the Air Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N. W. Washington, D. C.

DEC. 1-3—*American Society of Refrigerating Engineers,* winter meeting. Traymore Hotel, Atlantic City. R. C. Cross, secretary, 234 Fifth Ave., New York 1.

DEC. 10-17—*Nuclear Congress and Atomic Exposition.* Municipal Auditorium, Cleveland. American Institute of Chemical Engineers is the sponsor. Exposition director: Athel F. Denham, Atomic Exposition, 931 Book Bldg., Detroit 26.

JAN. 23-25—*American Society of Heating & Air-Conditioning Engineers, Inc.,* annual meeting. Sheraton-Gibson Hotel, Cincinnati. ASHAE headquarters: 62 Worth St., New York 13.

FREE CATALOG

tells why—

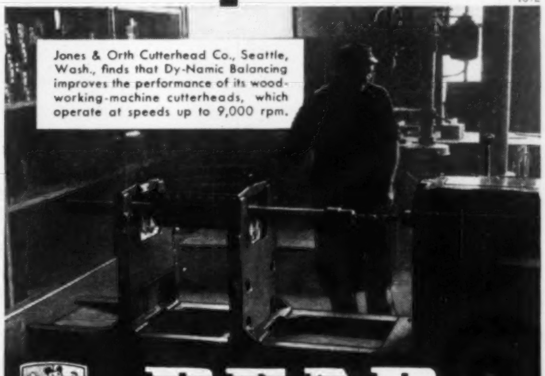
DY-NAMIC BALANCING

Improves performance of high-speed units like these!

Twenty-four pages of latest technological information, installation pictures, diagrams, and specifications—everything you want to know about the benefits of Dy-Namic Balancing! For your free copy, write: Bear Mfg. Co., Dept. H-16, Rock Island, Ill.

Get this FREE Dy-Namic Balancing CATALOG. Tells how the accurate Bear Balancing Machines improve YOUR product by reducing bearing wear, eliminating vibration and reducing mechanical failures. Any shophand can learn precision balancing in a few hours by the simple Bear method! Remember: *just one inch-ounce of un-balance becomes a destructive force of over 45 lbs. at 5,000 rpm!*

1012



Jones & Orth Cutterhead Co., Seattle, Wash., finds that Dy-Namic Balancing improves the performance of its woodworking-machine cutterheads, which operate at speeds up to 9,000 rpm.

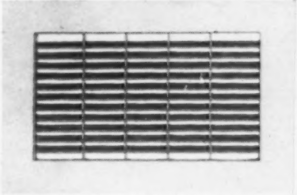
BEAR

STATIC AND *DY-NAMIC BALANCING* MACHINES

The Solid Bar

GRILLE or REGISTER

in SCHOOLS
in HOSPITALS
in PUBLIC BUILDINGS



Style #111-D (down deflection)

for STRENGTH · QUALITY · DURABILITY
SPECIFY R. & G. ALL THE WAY!

Solid 14 gauge Bars make the Grilles and Registers rugged and long lasting. Their interlocking construction makes them Tamper-proof — adjustable only with special tool provided with each order. Where you want the best in construction and performance — there is no other choice. It's R & G all the way!

- Constructed of sturdy 14 gauge steel bars.
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Complete Line of Registers and Grilles for
HEATING VENTILATING AIR CONDITIONING

REGISTER & GRILLE MFG. CO., INC.

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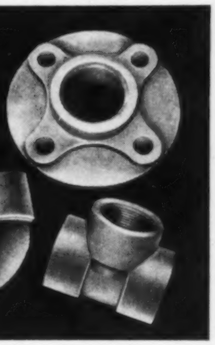

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Specify these injection-molded PVC fittings and flanges

Tube Turns Plastics, Inc. offers unplasticized PVC fittings made by the exclusive Hendry process. These injection molded fittings are superior to those made by conventional methods—minimum tensile strength of High Impact is 6000 psi, of Normal Impact, 7000 psi. Injection molding provides highest density, complete homogeneity. Tube Turns Plastics' fittings are non-toxic and completely inert. Resist both internal and external corrosion and will handle most chemicals up to 165°F. Investigate PVC for piping your corrosive materials. For booklet write Tube Turns Plastics, Inc., Dept. PC-7, 224 East Broadway, Louisville 1, Kentucky.

TUBE TURNS PLASTICS, INC.
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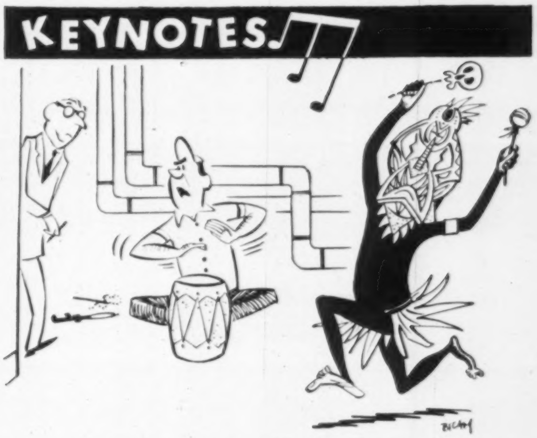
KEYNOTES



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Next time, use KEY-TITE® the easy-breaking seal. Send for FREE sample today.

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WATER PROOF
PIPE JOINT COMPOUND

SEALS TIGHT... BREAKS RIGHT!

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NEW BOOKS & REPORTS...

PERIMETER WARM AIR HEATING AND VENTILATING OF INDUSTRIAL, COMMERCIAL AND PUBLIC BUILDINGS—8 pp. National Warm Air Heating and Air Conditioning Association, 640 Engineers Bldg., Cleveland 14. 50c. (40 percent membership discount.)

INDUSTRIAL HYGIENE FOUNDATION, Transactions of 19th Annual Meeting, 1954—218 pp. Industrial Hygiene Foundation of America, Inc., Mellon Institute, 4400 Fifth Ave., Pittsburgh 13. $5.00.

CONDUCTION HEAT TRANSFER—By P. J. Schneider. 396 pp. Addison-Wesley Publishing Co., Inc., Cambridge 42, Mass. $12.50.

INDUSTRIAL AUTOMATIC CONTROLS—By Millard H. LaJoy. 278 pp. Prentice-Hall, Inc., Englewood Cliffs, N.J. $6.65.

SOLAR ENERGY RESEARCH—Edited by Farrington Daniels and John A. Duffie. 290 pp. University of Wisconsin Press, 811 State St., Madison. $4.00.

WATER POLLUTION ABATEMENT MANUAL ON OILS AND TARS—12 pp. Water Pollution Abatement Committee, Manufacturing Chemists' Association, 1625 Eye St., N.W., Washington 6, D.C. 25c.

HEATING, VENTILATING, AIR CONDITIONING GUIDE 1955—33rd Ed. American Society of Heating & Air-Conditioning Engineers, 62 Worth St., New York 13, N.Y. $12.00.

PERMISSIBLE DUSTINESS—By Theodore Hatch. 6 pp. Industrial Hygiene Foundation of America, Inc., Mellon Institute, 4400 Fifth Ave., Pittsburgh 13. Free.

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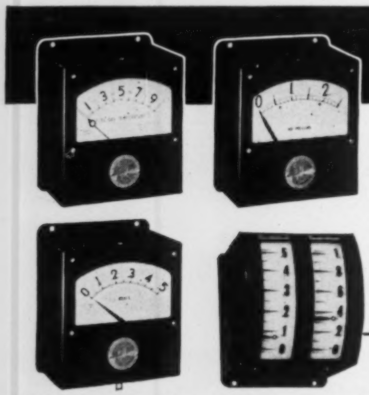

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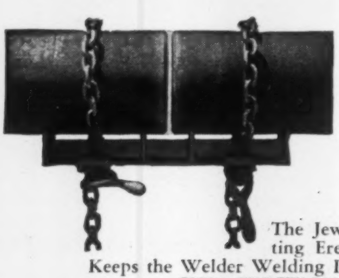

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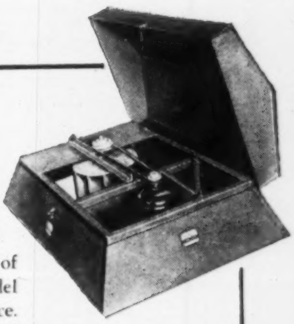

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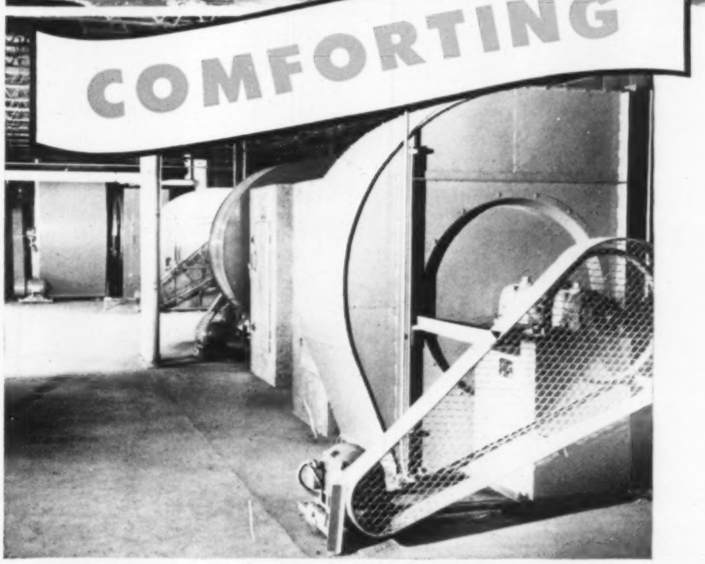

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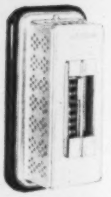

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